Vol. 9, No. 22
November 30, 1984

Energy Research Abstracts

Abstracts 45305-47238

Technical Information Center
Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1301; FTS 626-1301.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $5.00, foreign $6.25 per copy; annual cumulative index, domestic $16.00, foreign $20.00 per copy. The annual subscription price is $72.00 for domestic subscribers and $90.00 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign).

DOE Patents Available for Licensing (PAL)

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available on subscription as PB84-946800 from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $14.00 for domestic subscribers and $28.00 for subscribers outside the North American continent; prices for single issues are $7.00 and $14.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service, 5285 Port Royal Rd, Springfield, VA 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription for one volume (calendar) year (12 issues plus cumulative index) is $75.00 for domestic (North America) and $150.00 for foreign (outside North America) subscribers. A single issue is $7.00 (domestic) and $14.00 (foreign).

***Current Energy Patents (CEP)*–PB84-902800**

Provides coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization.

***Energy and the Environment (EAE)*–PB84-914900**

Devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

***Fossil Energy Update (FEU)*–PB84-914600**

Devoted to information on the exploration, development, processing, and use of fossil fuels.

***Fusion Energy Update (CFU)*–PB84-915300**

Devoted to information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

***Solar Energy Update (SEU)*–PB84-914500**

Devoted to information on the utilization of solar energy, including biomass and tidal and wind power.

The following semimonthly bulletins are also available from the National Technical Information Service. The annual subscription rate for one volume (calendar) year (24 issues; no indexes) is $40.00 for domestic subscribers and $80.00 for subscribers outside the North American continent; use the identifying order number (PB- No.) when subscribing.

***Acid Precipitation (APC)*–PB84-901000**

Covers all aspects of acid precipitation, including effects and possible control measures.

***Coal-Based Synfuels (CBS)*–PB84-901400**

Covers all aspects of conversion of coal into gaseous or liquid fuels.

***Coal Preparation and Pollution Control (CPC)*–PB84-900800**

Covers all aspects of coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB84-946600**

Covers the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Geothermal Energy Technology (GET)*–PB84-914700**

Devoted to information on the exploration, development, and utilization of geothermal resources.

***Laser Research (LAR)*–PB84-901100**

Covers all aspects of laser research and development, but excludes applications.

***Nuclear Fuel Cycle (NFC)*–PB84-913400**

Covers all aspects of the nuclear fuel cycle, both front end and back end.

***Nuclear Reactor Safety (NRS)*–PB84-913500**

Covers the following safety aspects: accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB84-902900**

Covers the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

***Solar Thermal Energy Technology (STT)*–PB84-901200**

Covers research in materials, concentrators/receivers, salinity gradients, etc., for development of efficient and reliable solar thermal conversion systems.

***Unconventional Petroleum (UCP)*–PB84-901300**

Covers all aspects of secondary and tertiary recovery of petroleum and of oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Office of Scientific and Technical Information, Technical Information Center (TIC) cooperates with the following organizations in the publication of international abstract journals: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts;* and (3) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts.* In each case, the cognizant foreign agency provides the non-U.S. information to TIC for inclusion in the Energy Data Base; in turn, TIC provides the U. S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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Vol. 9, No. 22
ISSN: 0160-3604
CODEN: ERABD
November 30, 1984

ENERGY RESEARCH ABSTRACTS

ABOUT THE TECHNICAL INFORMATION CENTER

The Office of Scientific and Technical Information, Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Scientific and Technical Information, Technical Information Center, P. O. Box 62, Oak Ridge, TN 37831.

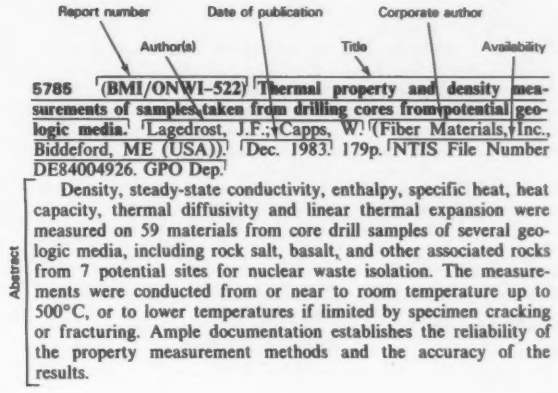
ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, TN 37831.

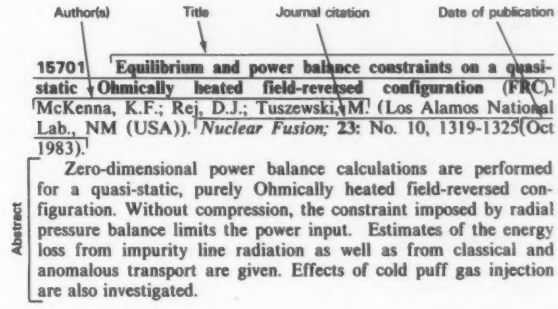
Technical Information Center, Office of Scientific and Technical Information
United States Department of Energy, P. O. Box 62, Oak Ridge, TN 37831

HOW TO USE *ENERGY RESEARCH ABSTRACTS*

ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Corporate author
Author(s)
Title
Availability
5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R:US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J:US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
Density
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
Energy Balance
Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)**	
	9:5785	BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under a File Number, that number is included in the availability statement. A File Number–Report Number Correlation is included for convenience.

BMI/ONWI-522	**9:5785**	**NTIS, PC A09/MF A01. File Number DE84004926, Distribution Category MN-70**

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Fachinformationszentrum
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Karlsruhe, Federal Republic of Germany

IEA Biomass Conversion Service
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National Institutes of Health
National Library of Medicine
Bethesda, MD

Plenum Publishing Corporation
New York, NY

University of Tennessee
Graduate School of Library and Information Sciences
Knoxville, TN

Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts,* Office of Scientific and Technical Information, Technical Information Center, P. O. Box 62, Oak Ridge, TN 37831.

SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

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01 COAL AND COAL PRODUCTS

45305 (CERCHAR-RA—1983) 1983 progress report of Coal Mining Research Center of France. (Centre d'Etudes et Recherches des Charbonnages de France (CERCHAR), 75 - Paris). Jul 1983. 76p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE84751842.

The CERCHAR (Centre de Recherches du Groupe Charbonnages de France) annual report presents the principal effort made in the coal use technology development. The researches in exploitation and security fields in mines are presented. CERCHAR activities concerning agreements and controls are developed. The different coal uses together with associated techniques and researches are exposed.

45306 (DOE/EIA—0492) National Coal Model (Version 5). Software manual. Orchard-Hays, W. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Sep 1984. 185p. NTIS, PC A09/MF A01; 1 - GPO; GPO Dep. File Number DE84017571.

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This report contains the users manual for software documentation for the National Coal Model - Version 5 (NCM5). From the standpoint of implementation, maintenance and operation, NCM5 is different from prior versions. This fact, together with the indistinct treatment of software in prior documentation, has led to the preparation of this software manual. The Software Manual stands between the Model Description and Formulation document and the Users Manual and the three are addressed to different audiences. The Model Description and Formulation document is addressed primarily to analysts although it contains important background and reference material for the other two manuals. The Users Manual is mainly an operational manual, both for data maintenance and run submission. These two important but disparate aspects of model documentation were not always clearly delineated in prior versions and, in any event, were often mixed with consideration from another area, namely software. A model of the nature of the NCM inevitably takes its existence in the form of computer programs, files and procedures of considerable complexity. Although, generally speaking, this subject does not attract as wide an audience as either the analytical description or the operational details, it is extremely important that it be explained clearly and neither be confused by nor itself confuse other subjects.

0104 Processing

REFER ALSO TO CITATION(S) 01040045352, 45354, 45388, 45388, 45391, 45393, 45393, 45925

45307 (ANL/FE—84-15) Metallic heat exchangers for coal gasification. Natesan, K. (Argonne National Lab., IL (USA)). Jul 1984. Contract W-31-109-ENG-38. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017439.

A high-temperature corrosion program is being conducted to evaluate the corrosion behavior of selected metallic alloys and coatings in mixed-gas atmospheres for application in heat recovery systems of coal gasification schemes. The experiments conducted with internally air-cooled specimens have established three key variables, namely the gas temperature, metal temperature, and gas chemistry. In addition, the alloy chemistry and exposure time have a strong influence on the corrosion scale morphologies and metal recession rates. The results showed that the scale growth in carbon steel and low- to medium-chromium steels is predominantly linear with time. Selection of these materials will be primarily based upon acceptable corrosion wastage rate. On the other hand, high-chromium alloys can develop thin oxide scales resulting in negligible wastage via corrosion, but are susceptible to accelerated corrosion in mixed-gas atmospheres. 6 references, 12 figures, 4 tables.

45308 (DOE/ET/10161—T1) Advanced coal gasification system for electric power generation. Monthly progress report, September 1975. Chamberlin, R.M.; Keairns, D.L.; Lancaster, B.W.; Salvador, L.A.; Sverdrup, E.F.; Vidt, E.J.; Pillsbury, P.W. (Westinghouse Electric Corp., Lester, PA (USA). Heat Transfer Div.). 10 Oct 1975. Contract AC01-76ET10161. 16p. (FE—1514-38). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016914.

This program carries along in parallel many analytical and experimental tasks necessary to evolve an Advanced Coal Gasification System for Electric Power Generation. The Process Development Unit's devolatilizer/desulfurizer has undergone cold flow dynamic tests; synthesis gas generators have been rebuilt and reinstalled; they have been tested at full pressure and temperature, and demonstrated to be completely satisfactory. Devolatilization tests at full temperature on sub-bituminous C coal will begin shortly. Test facilities for developing low-Btu gas burning combustors to be fitted into large utility gas turbines are now in operation. Current test work using 350°F fuel gas is concerned with minimizing CO and smoke emissions when operating both oil-fired and coal-gas-fired modes. A second generation coal gas combustor has been ordered, which embodies all the features found necessary as a result of the first year of testing. Maximum economic potential of this process will be realized by cleaning the product gas of particulates and trace contaminants at 1600°F before burning in the gas turbine. Tests of commercially-available cyclone collectors have shown results a little poorer than manufacturers' guarantees had led us to expect. Conclusion is that some form of granular bed filter will be necessary in a workable gasification plant. Test rigs have been constructed for realistic tests and are now operational on both a Donaldson Tan Jet Collector and a granular bed filter. Testing is under way on a 400°SCFM Aerodyne cyclone. Efforts to define the level of cleanliness which a modern gas turbine can tolerate in its fuel gas are as yet inconclusive. An analytical model which predicts rate of blade erosion as a function of particle sizes, densities and hardness is beginning to produce information. Physical models to provide factual information needed for effective use of the above are being designed.

45309 (DOE/MC/08722—T1) Electromagnetic techniques for mapping an underground coal gasification process. Final report, January 1, 1978-December 31, 1979. Balanis, C.A.; Radcliff, R.D.; Yoon, Y.K. (West Virginia Univ., Morgantown (USA). Dept. of Electrical Engineering). 1979. Contract AT21-78MC08722. 145p. NTIS, PC A07/MF A01; GPO Dep. File Number DE84017582.

An electromagnetic system, operating in reflection and transmission mode schemes, has been designed to monitor an underground coal seam gasification process. The overall dimensions of some system components have been restricted so that they may be placed inside a six-inch diameter borehole. Radiating elements have been designed, built, and tested to be used with the reflection and transmission mode schemes in the 174-216 MHz frequency range to monitor an underground coal gasification process within a thin (≈ 6 feet height) coal seam. The system has been tested in a laboratory, with restricted physical dimensions, to validate some of its design concepts. In addition numerical algorithms and computer programs have been developed to map, from the transmission mode scheme measurements, the underground process and its surrounding environment. 20 references, 43 figures, 9 tables.

45310 **(DOE/MC/19168—T1) Evaluation of mechanistic models for coal gasification. Quarterly technical progress report, June 19, 1983-September 18, 1983.** Padhye, A.R.; Sanetrik, M.D. (West Virginia Univ., Morgantown (USA). Dept. of Mechanical and Aerospace Engineering). 1984. Contract AT21-82MC19168. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017393.

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This report presents a summary of the work performed during the sixth quarter, June 19, 1983 to September 18, 1983, of a two-year study, conducted for US Department of Energy, under contract number DE-AC21-82MC19168. The objective of this research is to analyze, evaluate, and validate various fluidized-bed and entrained gasifier computer models. The emphasis of the sixth quarter work is on studying the actual FLAG computer code, and exercising of the code. The report also details results of minimum fluidization simulation using modified CHEMFLUB code. 5 references, 5 figures.

45311 **(DOE/METC—84/4) Symposium on electroslag component casting: proceedings.** Judkins, R.R.; Hobday, J.M. (eds.). (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract AC05-84OR21400. 246p. (CONF-8306237—). NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE84003075.

From Symposium on electroslag component casting; Morgantown, WV, USA (1 Jun 1983).

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The US Department of Energy (DOE), Office of Fossil Energy, Office of Surface Coal Gasification, has established a Materials Program to develop and apply appropriate materials to coal gasification plant components. The overall goals of the Surface Gasification Materials Program (SGMP) are to improve operational reliability and system durability and to reduce fabrication and operating costs of coal gasification plant components. The SGMP Electroslag Component Casting Project is directed to the development of electroslag casting (ESC) technology for use in coal conversion components such as valve bodies, pump housings, and pipe fittings. The aim is to develop a sufficient data base to permit ESC to become an ASME Code-accepted process. It is also intended to transfer the ESC process technology to private industry. This symposium was planned to discuss not only the SGMP Electroslag Component Casting Project but the activities and experiences of other organizations as well. The symposium addressed descriptions of electroslag processes; a worldwide perspective on the status of ESC technology; and details of production, mechanical properties, economics, and use of ESC for coal gasification components. Ten papers were presented, and a panel discussion was held to provide participants an opportunity to express their opinions and to offer recommendations on the content of the DOE program. This document constitutes the proceedings of that symposium. The papers included here are minimally edited transcripts of the presentations made at the symposium. All papers have been processed for inclusion in the Energy Data Base.

45312 **(DOE/OR/03054—18) Solvent refined coal (SRC) combustion Demonstration Support program. Final technical report.** (Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.; International Coal Refining Co., Allentown, PA (USA)). Apr 1983. Contract AC05-78OR03054. 341p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE84011293.

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A combustion support program with the objective of characterizing the complete and environmentally acceptable combustion of solvent-refined coal (SRC) solid and liquid fuels in environments characteristic of existing coal-, oil-, and gas-fired boilers was conducted. SRC fuel forms investigated were SRC, SRC residual fuel oil, SRC middle distillate fuel oil, two-stage liquefaction solvent refined coal (TSL SRC) and TSL SRC residual fuel oil. Firing SRC and TSL SRC with a slow mix long flame, NO emission limits can be held below New Source Performance Standards (NSPS - 0.5 lb NO_2/million Btu) by firing with low excess air. Combustion efficiency was good (99.59 +- 0.24%). Firing pulverized SRC with a rapid mix short flame is difficult because SRC softens and plugs devices intended to mix fuel and air. Based on tests that lasted only a short time (due to plugging), rapid mix firing of SRC will increase NO emissions so that an NO reduction technique, such as staged combustion, will be required to meet NSPS. Tangential pilot-scale firing of pulverized SRC was very successful. For all SRC liquid fuels, flame length was short indicating rapid mixing. For liquid fuels, the largest factor affecting NO emissions is fuel nitrogen content. For SRC middle distillate (fuel N = 0.70 percent), desired NSPS NO limits (0.5 lb/million Btu) can be achieved with either low excess air (less than 5 percent) or moderate air staging. Particulate emission for all of the liquid fuels appear to be much less than desired retrofit limits (e.g., 0.1 lb/million Btu).

45313 **(DOE/OR/03054—48-Vol.2) ASPEN simulation of the SRC-I process area baseline design. Appendixes A to C. Volume 2. Final technical report.** Gimson, G.D.; Duffy, R.S. (International Coal Refining Co., Allentown, PA (USA)). Sep 1983. Contract AC05-78OR03054. 576p. NTIS, PC A25/MF A01; 1; GPO Dep. File Number DE84015373.

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This volume consists of appendices which identify components, thermodynamic methods and models, and certain constants for these models; and (2) ASPEN computer codes for the various plant sections. (LTN)

45314 **(DOE/OR/03054—53) R and D summary final reports.** (International Coal Refining Co., Allentown, PA (USA)). Sep 1983. Contract AC05-78OR03054. 99p. NTIS, PC A05/MF A01; GPO Dep. File Number DE84017406.

This report is a compilation of summaries of each subcontracted and internal SRC-I R and D program conducted under the SRC-I contract DE-AC05-78OR03054. All of the R and D program activities were performed in order to provide necessary support data for the design of an SRC-I Demonstration Plant. All of the completed research programs are identified in the table of contents. Each summary includes a brief abstract, objectives, conclusions, and recommendations for additional R and D, as well as a reference to detailed reports published on the program. These detailed reports are available from NTIS or TIC under the contract number and the unique serial number listed. The research activities were undertaken after the Research and Development (R and D) Plan developed and identified the need for programs required to support the demonstration plant: technology gaps and proposed specific R and D programs to ensure the technical viability and acceptability of the demonstration plant; and management information required to implement laboratory and pilot plant programs. Only those tasks which yielded reportable results have been published. Some programs identified in the plans were not initiated or were terminated due to budgetary constraints. Environmental and Product Development and Applications Engineering Activities are summarized in the SRC-I Project Closeout Reports and are generally not included in this volume. This report may be a useful lead to results on these support projects. (LTN)

45315 **(DOE/OR/03054—64) Effect of asphaltene- and preasphaltene-rich solvents upon coal liquefaction. Internal R and D final report.** Kang, D.; Givens, E.N. (International Coal Refining Co., Allentown, PA (USA)). Sep 1983. Contract AC05-78OR03054. 137p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84017014.

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This report summarizes R and D work (Programs 12.1.4 and 12.1.12) performed by International Coal Refining Co. to address the design option of recycling solvent-refined coal (SRC) to the coal-slurry feed stream in the SRC-I Demonstration Plant. The major objective was to determine if solvent yield could be increased by recycling SRC, to prevent the plant from inadvertent solvent imbalance. The effect of SRC recycle on reactor yields was evaluated over a range of process conditions, using Kentucky No. 9 coals in a variety of SRC-enriched process solvents. Both light and heavy SRCs, produced from the Kerr-McGee critical solvent deashing unit at the Wilsonville Advanced Coal Liquefaction Facility, were recycled. Advantages and disadvantages of including the recycle process in the plant design are discussed in comparison with the baseline design. 12 references, 34 figures, 45 tables.

45316 (DOE/OR/03054—65-Vol.1A) Evaporator cake solid waste stabilization studies. Vol. 1A. (International Coal Refining Co., Allentown, PA (USA)). Mar 1984. Contract AC05-78OR03054. 65p. NTIS, PC A04/MF A01; GPO Dep. File Number DE84013633.

As part of its contract to design, build, and operate the SRC-I Demonstration Plant in cooperation with the US Department of Energy (DOE), International Coal Refining Company (ICRC) was required to submit a design for the plant Wastewater Treatment System that specified Zero Discharge of treated effluent as the primary operating mode. Successful implementation of Zero Discharge will rely on acceptable disposition of the 60 to 120 tons per day of evaporator cake (solid waste) generated by the demonstration plant. This three-volume report presents the results of studies that investigated the feasibility of stabilizing SRC-I solid waste in an environmentally acceptable manner. The report also describes three alternate systems for the stabilization of solid waste generated by the demonstration plant and provides a summary of costs for each system. The report includes a discussion of the impact on solid waste stabilization systems of increased production capacity in the demonstration plant. Also included is a discussion of the impact of process variations in the demonstration plant on solid waste stabilization systems.

45317 (DOE/OR/03054—73) Gasifier slag and feedstock physical properties. Final technical report. Mills, K.C.; Putland, F.H.; Richardson, M.J. (National Physical Lab., Teddington (UK); International Coal Refining Co., Allentown, PA (USA)). Sep 1983. Contract AC05-78OR03054. 59p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017011.

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Measurements of heat capacity and enthalpy have been carried out on 10 samples consisting of 5 coals and 5 KMACs, and on the ashes formed by these materials. In addition, the melting range of two of the ashes was measured using differential thermal analysis. A model for estimating heat capacity and enthalpy values of slags has been developed.

45318 (DOE/OR/03054—97) Impact of native solvent on SRC-I coal process development unit data base. Final technical report. Kang, D.; Hoover, D.S.; Givens, E.N. (Air Products and Chemicals, Inc., Allentown, PA (USA)). Jan 1984. Contract AC05-78OR03054. 73p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017013.

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A program was conducted to determine whether data generated in ICRC's coal process development unit using a general source of solvent rather than the native solvent derived from the coal being liquefied would be adequate for design purposes. ICRC's entire data base was generated from runs that used general or foreign solvents, because of the time and cost constraints involved in using specific native solvents. In the current program, a native solvent was produced in quantity and used in a series of coal liquefaction runs, both by itself (baseline) and blended with 30% solvent-refined coal (HSRC). Results showed that hydrocarbon gas yields and hydrogen consumption increased when foreign solvent was used, but the data could be corrected to mimic the native solvent data. Oil yields with foreign solvent at most low-severity process conditions increased, and asphaltene yields were significantly lower. These foreign solvent yield data can be corrected to those for native solvent, but not as accurately as hydrocarbon gas yields and hydrogen consumption. Several factors may be responsible for the discrepancies, including differences in boiling-point distribution between the solvents, asphaltene formation in solvents that are stored, and different equilibrium states in solvents due to different reactor hydrodynamics and feed coals. 6 references, 38 figures, 10 tables.

45319 (DOE/OR/03054—106) Phase equilibrium data for coal-derived liquids: mixture of model compounds. Subcontracted R and D final report. Mehta, D.C.; Craft, S.; Ho, C. (International Coal Refining Co., Allentown, PA (USA); Chromaspec Corp., Houston, TX (USA)). May 1984. Contract AC05-78OR03054. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017012.

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ICRC initiated a test program to develop VLE and enthalpy data on selected model compounds and on well-defined coal liquids. The results obtained from the model compounds would be used to improve existing correlations in their application to coal liquefaction equipment design. The data on the coal liquids would be helpful in optimizing the design and operation of the corresponding equipment in the SRC-I Demonstration Plant. The overall test program was divided into four tasks: (1) Sample Acquisition and Preparation, (2) VLE Measurements, (3) Enthalpy Measurements, and (4) Analytical Characterization. Tasks 1 and 4 were performed by Air Products and Chemicals, Inc. (APCI). Task 2 was contracted to Chromaspec Corp., and Task 3 was performed by Colorado School of Mines (CSM). The ICRC work at Chromaspec was divided into two phases: the first phase covered VLE measurements of model compounds and coal liquids in the presence of hydrogen-rich gas at demonstration plant operating conditions; the second phase reported herein, covers VLE measurements on mixtures of polar model compounds. The results of the VLE measurements on mixtures of model compounds are presented in the attached Chromaspec report. The timing of the availability of results from Chromaspec did not permit incorporating them in the correlation development work at APCI. In spite of the schedule, the work at Chromaspec was continued so that the experimental setup could be fully utilized to develop all the necessary VLE data on the coal liquids and model compounds. 4 references.

45320 (DOE/OR/03054—106, pp 18p, Paper 1) Thermodynamic data for coal liquefaction. Final report. May 1984. NTIS, PC A03/MF A01. File Number TI84017012.

In Phase equilibrium data for coal-derived liquids: mixture of model compounds. Subcontracted R and D final report.

This phase-equilibrium study was the second phase of a test program to collect vapor-liquid equilibrium data for use in coal liquefaction. Phase equilibrium experiments were performed on pairs of acid, base, aromatics and saturate (ABAS) model compounds for correlation purposes. The following pairs were tested: B-Naphthol + Acridine - Acid/Base; Mesitylene + 9,10-Dihydrophenanthrene - Small/Large Aromatic; m-Cresol + B-Naphthol - Association Among Acids; Decalin + 9,10-Dihydrophenanthrene - Saturate/Polynuclear Aromatic; and Eicosane + Phenanthrene - Linear Saturate/Polynuclear Aromatic. Vapor-liquid equilibrium for each pair of components were run with initial molar mixes of 20, 50, and 80 mole percent of the first component. Two isotherms, at 400°F and 600°F, for each mixture were determined. An additional experiment was performed at 700°F for Decalin-9,10-Dihydrophenanthrene pair with 50-50 initial molar mix. 6 tables, 6 figures.

45321 (DOE/OR/03054—112) Computer simulation of solidification processes considered for the SRC-I Demonstration Plant. Moujaes, S.F. (International Coal Refining Co., Allentown, PA (USA)). Jun 1984. Contract AC05-78OR03054. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017420.

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In the SRC-I Demonstration Plant, one-third of molten SRC produced, or about 74,000 lb/hr, will be solidified. Although a batchwise (Rexnord) solidification process was included in the 1982 Baseline Design. ICRC has been evaluating water-bath solidification as an alternative during the Post-Baseline period. In order to better understand the effect of the different parameters involved in both technologies, two computer simulation models using transient heat conduction have been developed. Experimental data on slab temperatures have been obtained using an infrared technique to evaluate the Rexnord technology. Comparison of the computer simulation results to the available data shows that the model simulates reasonably well the transient thermal behavior of the slab. The model showed that in Rexnord solidification the thickness of the slab, the thermophysical properties of the product, and the solidification temperature play an important role in determining the cooling time required to produce a firable product. Simulation of the water-bath solidification process showed that it is a faster cooling process than the Rexnord process, because of its higher heat-transfer coefficients and higher surface area-to-volume ratio. However,

no detailed experimental results about SRC-I pencil temperatures were available for verification. Using the design conditions recommended for both technologies, the cooling times were predicted and compared to the Baseline Design. This was accomplished by using the detailed thermophysical data for three streams in our computer programs. Results showed that for the batch process, two of the three samples would be solidified within the Baseline's 8-min cooling time. The third sample had a lower softening point and required more time. All of the times for the water-bath process were shorter than those for the batch technology. 10 references 16 figures, 3 tables.

45322 **(DOE/PC/60778—3) Chain hydrogenolysis and hydrogen atoms in coal conversion. Quarterly report No. 3, March 2, 1984-June 30, 1984.** Ross, D.S.; McMillen, D.F. (SRI International, Menlo Park, CA (USA)). Aug 1984. Contract FG22-83PC60778. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017321.

The conversion of coal to upgraded liquids in donor-containing media has been an area of study for a number of years, and a large number of reaction schemes or models have been proposed for the process. The approach generally presumes a sequential reaction series in which coal is first converted to an initial product, preasphaltene or asphaltol, which in turn proceeds to asphaltene and oil products. The research being conducted on this program includes both the development of a new model for coal conversion, and experimental work on the conversion of coal in CO/water systems. This report discusses progress in the modeling; the experimental data considered at present were developed in a DOE program just concluded (DOE Contract No. DE-AC22-81PC40785). The model under development is relatively simple in that we consider only toluene solubility (TS) as the conversion diagnostic - any fraction not soluble in toluene is considered undesirable. The toluene-soluble fractions from coal conversions are generally recognized as containing the majority of the distillables, and this approach is thus apropriate. Second, the model directly recognizes that the reactive portions of the coal are thermally consumed in parallel to conversion to TS, or to unconvertible, toluene-insoluble char. Thus in a given coal product mixture, only three fractions are considered - the TS material, char, and unreacted coal. This approach not only simplifies the modeling effort, but also explicitly recognizes the competitive features inherent in the kinetics operative in coal conversion specifically involving the parallel conversions to TS and char. The primary purpose of this modeling approach is not necessarily to parameterize for prediction purposes, but rather to facilitate asking the appropriate question about the chemistry responsible for the observed parametric behavior.

45323 **(NP—4770367) Kinetics of formation of BTX-aromatics during pressure pyrolysis of coal in nitrogen and hydrogen atmospheres.** Bunthoff, D. (Essen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich Chemie). 9 Feb 1982. 176p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE84770367.

The kinetics of formation of benzene, toluene and the isomers of xylene during pyrolysis of varions coals under nitrogen and hydrogen atmospheres was studied in a differential reactor with thermobalance and connected gas analysis. A sample of approx. 1 g was heated from 100°C to 950°C at a constant rate of heating of 3 K/min. Since the rate of heating was low, it was possible to follow continuously as it were, the rate of formation of the BTX-aromatics, C_1-C_2 hydrocarbons carbon oxides and water with the aid of gas chromatography. During the whole heating-up period the weight loss of the sample was recorded continuously on the thermobalance. The difference between the liberation of gas and weight loss was designated as tar for the sake of simplicity and its formation was measured wich time. The precipitated tar could be analysed at the end of the study.

45324 **(NP—4770382) Mass transfer and increase in gas permeability in the 'in situ' gasification of low-lying coal seams.** Breidung, K.P. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 28 Jul 1982. 146p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84770382.

A knowledge of mass transport in coal deposits is of particular importance for "in situ" coal gasification through boreholes. Underground paths of flow between boreholes occur naturally in pore-systems of coal and can be created in addition by suitable techniques. The influence of the gasification process on mass transport behaviour in natural pathes of flow is investigated in black coal with caking and swelling properties. The results are used to evaluate the practicability of underground gasification.

45325 **(NP—4901785) Evaluation of organic sulfur removal from Ohio coals. Final technical report.** Porter, C.R. (Nedlog Technology Group, Arvada, CO (USA)). 15 Aug 1980. 55p. Dept. of Development-Division of Energy, Box 1001, Columbus, OH 43216. File Number TI84901785.

This research program was undertaken to evaluate the reaction of theoretical coal model organosulfur compounds and the removal of organic sulfur from an Ohio coal with iron pentacarbonyl. A comprehensive computerized literature search revealed numerous citations on the reactions of organosulfur and iron carbonyls. An experimental program verified that the reactions of organosulfur and iron pentacarbonyl proceed at moderate temperature (60 to 80°C) and atmospheric pressure. The experimental conditions used in desulfurization tests on an Ohio coal produced from 6% to 14% reduction in total sulfur. 9 references.

45326 **(NP—4901787) Desulfurization of coal. Final report.** Dichter, M.; Sanduja, M. (Polymer Research Corp. of America, Brooklyn, NY). Oct 1980. 63p. Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43214-1001. File Number TI84901787.

Ohio coal, like many other types of coal, has a high sulfur as well as ash content. We at PRCA, through a series of steps involving the treatment of coal with an olefin-catalyst and/or catalyzed oxidizing system, have established the following: (1) Crushing and pulverizing of coal to a size of 150 to 200 mesh is an important factor in the process of desulfurization, as this allows improvement of the efficiency of flotation and chemical desulfurization. (2) Flotation results in a significant reduction of sulfur and ash content of the coal and reduces the amount of water absorbed on the pulverized coal when petroleum fractions are introduced into the flotation process. Coal containing 4.3% and 2.7% sulfur have been desulfurized to 2.8% to 3.0% and 1.5% to 1.9%, respectively. The ash content has been reduced after flotation from 10.7% to 6.5% of the Pittsburgh No. 8 coal and from 16.5% to 10.5% of a coal provided by Consolidation Coal Co. (3) Chemical treatment with olefins and monomers allows complete removal of the rest of the pyritic sulfur and part of the organic sulfur. The higher molecular weight olefins give better results and an introduction of some maleic anhydride monomer helps to get a higher reduction of the sulfur in the coal. The presence of an alkaline medium (NaOH or Na_2CO_3) enhances the sulfur removal efficiency. (4) Elevated temperatures and pressures allows reduction of the time of reaction to obtain lower sulfur content coal. However, the pressure in the range of 100 to 200 psi allows achievement of an optimum desulfurization of treated coal. Even 25 to 30 psi has shown satisfactory results in the same time. (5) The results of desulfurization by a monomer (olefin) treatment are given. Further work on the desulfurization of the Ohio coals is recommended in a small scale pilot plant on a continuous basis. This pilot plant will represent an approximation of a real plant which will allow the necessary insight needed for scale up.

45327 **(NP—4901803) Continuous gasification tests using clean pellet fuel.** (McDowell Wellman Engineering Co., Cleveland, OH (USA)). Jan 1980. 139p. Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216. File Number TI84901803.

The Ohio Department of Energy has sponsored an ongoing development program with McDowell-Wellman Company concerned with production and utilization of clean pellet fuel. A previous short duration gasification test carried out with pellets yielded some favorable preliminary results and more extensive tests were warranted. This report presents results of production runs and a seven-day gasification test with a Wellman-Galusha gas producer of The National Lime and Stone Company at Carey, Ohio. Four consecutive days of a gasification test were carried out with about 270 tons of clean pellet fuel and several days before and after were used for obtaining data of normal coal gasification operations for pur-

poses of comparison. The production of the pellets in the McDowell-Wellman pilot plant provided some further operational data which are applicable to design of demonstration and commercial plant systems. These data also demonstrated the favorable production, storage, and handling characteristics of the pellets. The gasification tests showed that the pellets handled and functioned favorably in the Wellman-Galusha gas producer. In comparing the producer gas with gas made from normal select bituminous coal the following general comments refer to producer gas made from clean pellet fuel: (1) gas is cleaner and markedly lower in tar and particulate content; (2) gas is of higher moisture content and lower hydrocarbon content and lower in temperature; (3) gas is very low in sulfur verifying a marked fixation of sulfur during gas making operations.

45328 **(ORNL—6036) Inspection of selected vessels of the H-coal pilot plant at Catlettsburg, Kentucky.** Keiser, J.R.; Olsen, A.R.; Judkins, R.R.; Nave, J.W.; Jones, J.W. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84016649.

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Operation of the Catlettsburg, Kentucky, H-Coal pilot plant was terminated in November 1982 at which time a complete inspection of the plant was made by Ashland Synthetic Fuels, Inc. (ASFI) engineers and inspectors. At the request of the Major Coal Liquefaction Projects' Office of the Department of Energy's Oak Ridge Operations, engineers and photographers from Oak Ridge National Laboratory (ORNL) supplemented the ASFI inspection by twice visiting the pilot plant and examining a number of vessels, several of which had a history of serious corrosion problems. This report presents the results of the ORNL inspections and includes extensive photographic documentation of the more severe corrosion in the fractionation area and in the H_2S-NH_3 stripper.

45329 **Aspects of the chemistry of donor solvent coal dissolution: Promotion of the bond cleavage reactions of diphenylalkanes and the related ethers and amines.** King, H.H.; Stock, L.M. (Department of Chemistry, The University of Chicago, Chicago, IL). *Fuel;* 63: No. 6, 810-815(Jun 1984).

The influences of Illinois No. 6 coal, benzyl phenyl sulphide, 9, 10-anthraquinone, tetracene, phenol and benzoic acid on the rates of decomposition of 1,2-diphenylethane, 1,3-diphenylpropane, 1,4 diphenylbutane, benzyl phenyl ether, dibenzyl ether, N-benzylaniline, and dibenzylamine in tetralin have been investigated. Radical initiators such as benzyl phenyl sulphide enhance the rate of decomposition of the compounds that form benzylic radicals which can decompose via β-scission reactions. Weak organic acids enhance the reaction rates of the compounds, for example, benzyl phenyl ether and N-benzylaniline, that undergo the homolysis reaction via polar transition states. Among the reactive initiators considered in this paper, benzyl phenyl sulphide is the only compound which, in small quantities, accelerates the conversion of Illinois No. 6 coal to pyridine-soluble products in tetralin at 400°C. The facile reactions of Illinois No. 6 coal with tetralin and the accelerating effects of benzyl phenyl sulphide, anthraquinone, tetracene and phenols on the decomposition of the diphenylalkanes and the related heteroatom analogues are discussed.

45330 **Effect of tetralin dissociation on coal liquefaction: tubing bomb versus batch autoclave.** Chien, P.L.; Weller, S.W. (Dept. of Chem Eng., State Univ. of New York at Buffalo, Buffalo, NY). *Fuel;* 63: No. 6, 878-879(Jun 1984).

The extent of coal hydroliquefaction in the presence of a good catalyst (impregnated ammonium heptamolybdate) and a hydrogen-donor solvent (tetralin) can be substantially greater in a tubing bomb than in a stirred autoclave, under nominally identical liquefaction conditions. This difference may be associated with the typically lower gas:liquid volume ratio existing under reaction conditions in a tubing bomb, relative to the ratio in an autoclave. If equilibrium is reached in the catalysed dissociation of tetralin, the extent of dissociation is less, and the hydrogen partial pressure is substantially higher, in the tubing bomb than in the autoclave. Calculations and measurements have been made for the equilibrium conditions in tetralin dissociation when coal is absent but a good catalyst (ammonium heptamolybdate dispersed on alumina) is present. For the calculation, the molar volumes and vapour pressures of tetralin and naphthalene must be known, together with the dissociation constant. Agreement was good between calculated and experimental values of dissociation in both tubing bomb and autoclave. The results permit prediction that increasing the gas:liquid volume in a tubing bomb liquefaction experiment should decrease the conversion; this effect was observed.

45331 **Hydroliquefaction of Kentucky 9/14 coal using bottoms recycle.** Silver, H.F.; Corry, R.G.; Hurtubise, R.J.; Miller, R.L. (Chemical Eng. Dept., University of Wyoming, Laramie, WY). *Fuel;* 63: No. 6, 872-874(Jun 1984).

Kentucky 9/14 bituminous coal has been liquefied in a batch reactor using blends of distillates and SRC or SRC fractions as the solvent. The most effective solvents contained either mildly hydrogenated SRC or the cyclohexane-soluble oil fraction of SRC. Approximately 65 wt% of Kentucky 9/14 coal was converted to C_4-700K liquids using these solvents. This yield can be compared to a yield of $\approx$ 40 wt% C_4-728K produced in the SRC-II process from Kentucky 9/14 coal.

45332 **Displacement of retained pyridine by aqueous tetrahydrofuran from Illinois No. 6 coals.** Chambers, R.R.; McKamey, D. (Chemistry Division, Oak Ridge National Lab., Oak Ridge, TN). *Fuel;* 63: No. 6, 868-870(Jun 1984).

It has been found that repetitive washing of an Illinois No. 6 vitrain and O-methylated Illinois No. 6 vitrain containing 10.7 and 7.9 wt% pyridine, respectively, with a 5% (v/v) tetrahydrofuran in water solution followed by vacuum drying at 110°C (18 h) effectively removes all of the retained pyridine. Experiments with ^{14}C-labelled THF established that tetrahydrofuran is not retained under these conditions in significant amounts (<1.2% by weight) by either of the two coals. Furthermore, the difference in weight before and after the extraction agrees well with the amount of pyridine initially present indicating only small (<5%) losses of coal during this process. Plots of per cent pyridine released versus vol% THF are consistent with a displacement mechanism in which THF penetrates the coal matrix and replaces the adsorbed pyridine.

45333 **Kinetic rate model interpretation of the SRC-II liquefaction of an Ireland Mine coal.** King, W.E. (Gulf Research and Development Company, Pittsburgh, Pennsylvania). *Fuel;* 63: No. 5, 600-603(May 1984).

An experimental data base for characterizing the SRC-II liquefaction of an Ireland Mine coal is interpreted using an empirical rate model developed from SRC-II liquefaction data for a Powhatan No. 5 coal exclusively. The model predictions for hydrogen consumption and for the yields of the key components; C_1-C_4 gases, C_4-755 K liquids, and solvent-refined coal (SRC) are compared with the experimental values over a wide range of reactor operating conditions; temperature (703-743 K), pressure (10.2-20.4 MPa), and recycle ash (2.0-10.4 wt%). Model predictions are in good agreement with hydrogen consumption measurements at baseline conditions (728 K and 13.6 MPa) and at more severe conditions (743 K and 20.4 MPa) for a feed slurry containing 30 wt% coal and 10.4 wt% recycle ash (absolute error + or - 6.4%). A similar result is obtained for the C_1-C_4 gases and the C_4-755 K liquids at the baseline conditions; however, the error in the SRC yield prediction is higher (+ or - 12.1%). The model predictions for the key components at the higher severity conditions deviate more than those for the baseline conditions.

45334 **Effect of nitrogen content of solvent on coal liquefaction.** Panvelker, S.V.; Cronaver, D.C.; Ge, W.; Shah, Y.T. (Department of Chemical and Petroleum Engineering, University of Pittsburgh, Pittsburgh, Pennsylvania). *Industrial and Engineering Chemistry Fundamentals;* 23: No. 2, 202-207(May 1984).

SRC-II recycle solvents contain substantial amounts of heterocyclic compounds such as quinoline; hydrogenated derivatives of such compounds can be good H-donors. In addition, hydrogenation of quinoline to tetrahydroquinoline is faster than that of the corresponding homocyclic aromatic compound such as naphthalene. Hence, such compounds should aid in maintaining the H-

donor capability of recycle solvents at high levels during all phases of coal conversion. In a series of coal liquefaction runs made to test this premise, there was no effect of tetrahydroquinoline addition to hydrogenated phenanthrene and SRC-II solvent on the product distribution from coal liquefaction. However, there was a very pronounced effect with anthracene oil as solvent. Adduction of tetrahydroquinoline led to a net loss of solvent and a very high yield of asphaltenes. These results indicate the formation of adducts through the reactions of solvent and coal species. The level of adduction lessened with extended reaction times, indicating some reversibility.

45335 **Laser-based analysis of coal gasification streams.** Hartfort, A. (Los Alamos National Laboratory, Los Alamos, NM). *Laser Focus with Fiberoptic Technology;* **20**: No. 4, 63-64(Apr 1984).

Initial tests of the CARS and LIBS techniques on operational coal gasifiers have proved extremely encouraging. Both methods have been shown to provide real-time response, as well as the ability to monitor specific constituents in the process stream. Since the diagnostics prove capable of probing the harsh environment of a coal gasifier, it is reasonable to assume that they will be applicable to numerous chemical processes.

45336 **Tetralin dissolution of macerals separated from a single coal.** King, H.H.; Dyrkacz, G.R.; Winans, R.E. (Argonne National Laboratory, Argonne, IL). *Fuel;* **63**: No. 3, 341-345(Mar 1984).

The maceral density fractions separated from bituminous coals were reacted with tetralin at 420°C for 6 min. Both THF and pyridine solubility decrease smoothly with an increase in density or a decrease in H/C atomic ratio. In addition, a higher carbon aromaticity leads to a lower conversion. The average molecular size of the THF soluble products decreases as the density of the starting sample increases. Inertinite consumes more hydrogen to reach the same degree of conversion. Possible reasons for this result are discussed.

45337 **Identification of the combustion behaviour of lignite char between 350 and 900°C.** Tseng, H.P.; Edgar, T.F. (Dept. of Chem. Eng., The Univ. of Texas at Austin, Austin, TX). *Fuel;* **63**: No. 3, 385-393(Mar 1984).

The combustion behaviour of four different lignite samples pyrolysed at 800 and 1000°C has been studied. The reaction order and the activation energy of the char combustion reaction can be easily determined from the time to reach 50% conversion. Under 550°C the reaction order of lignite samples are 0.7 and the activation energies are 27.4–27.9 kcal $gmole^{-1}$. Above 550°C the measurement of the intrinsic reaction rate is limited by the film diffusion resistance. The pyrolysis temperature affects the reactivity significantly. The reactivity of char pyrolysed at 800°C is 3.5 times that of char pyrolysed at 1000°C.

45338 **The Great Plains Coal Gasification Project.** Bodnaruk, B.J. (U.S. Department of Energy, Chicago Operations Office, Argonne, Illinois). pp 215-219 of Technical economics, synfuels and coal energy symposium. Dicks, J.B. New York, NY, USA; A.S.M.E. (1984). (CONF-831111—).

From ASME winter annual meeting; Boston, MA, USA (13 Nov 1983).

The Great Plains Gasification Project will be the first commercial-size plant to produce substitute natural gas from coal in the United States to be completed in December 1984. The plant will convert 14,000 tons of lignite into 125 million standard cubic feet of gas per day. The Department of Energy has guaranteed up to $2.02 billion and the Partnership contributes up to $700 million of equity. The objective of the project is to demonstrate the technical, economic, and environmental acceptability of the process. The DOE-Chicago Operations Office has been assigned the responsibility for monitoring the Project's performance against baselines of cost, schedule, and technical criteria.

45339 **Testing of high-temperature slurry pump packings for coal liquefaction services.** Hao, B.R.; McCabe, J.T. (Mechanical Technology Inc, Latham, NY). pp 127-129 of Technical economics, synfuels and coal energy symposium. Dicks, J.B. New York, NY, USA; A.S.M.E. (1984). (CONF-831111—).

From ASME winter annual meeting; Boston, MA, USA (13 Nov 1983).

State-of-the-art, commercially available packings for the slurry feed pumps used in coal liquefaction pilot plants in the United States were subjected to a test program that included an analysis of the packing failures experienced at the pilot plants and a survey of the packing designs commercially available in the United States. Selected packings were tested in the laboratory and, later, in pilot plants. The laboratory tests consisted of static solvent compatibility tests and dynamic wear tests using a modified commercial plunger pump. In the field, selected packing designs were tested at two coal liquefaction pilot plants. Based on the test results, recommendations on the best packings for coal slurry feed pump services were made.

45340 **Direct liquefaction.** Thomas, M.G. (Sandia National Laboratories, Albuquerque, NM). pp 231-261 of The science and technology of coal and coal utilization. Cooper, B.R. New York, NY, USA; Plenum Press (1984).

This chapter examines the thermally induced decomposition of coal in the presence of a solvent that serves to transfer hydrogen. The solvent-free, coal-derived materials are complex organic solids with melting points of 200°C and above. Topics considered include historical aspects, types of coal, thermal chemistry (stoichiometry, mechanisms, effects of independent variables, current concepts on rates and activation energies), catalytic chemistry (objectives, effects on coal dissolution, effects on preasphaltene decomposition, synergistic effects with catalysts, catalytic mechanisms), and direct liquefaction technology (current status and advanced concepts). Direct liquefaction is a thermal, fairly non-selective process that relies on a number of free-radical initiated reactions to fragment the coal molecules, add hydrogen, and remove oxygen, sulfur, and nitrogen. Catalysis improves the rates of hydrogenation to some extent, but the full advantages of the catalytic effects are not obtained due to the severity of the time-temperature regimes employed for direct liquefaction.

45341 **Pyrite-catalysed coal liquefaction using quinoline/tetrahydroquinoline as an H-donor system.** Guin, J.A.; Curtis, C.W.; Kwon, K.C. (Auburn Coal Conversion Laboratory, Auburn University, Auburn, AL). *Fuel;* **62**: No. 12, 1412-1416(Dec 1983).

Pyrite catalyzes the hydrogenation of the N-containing ring in quinoline (Q) to form the active H-donor, 1,2,3,4-tetrahydroquinoline, (THQ). THQ is shown to dissolve coal readily at 325°C, a temperature lower than that commonly used in most liquefaction processes. Pyrite is effective for maintaining the Hdonor capacity of the solvent by hydrogenating the Q formed after H-donation, thereby providing the high THQ/Q required for sustained operation. Qualitative observations suggest that some source of hydrogen, either molecular or donor, must be present to prevent retrogressive reactions of coal fragments.

45342 **Hydrocracking of diphenylmethane: Roles of H_2S and pyrrhotite.** Stenberg, V.I.; Miller, D.; Ogawa, T.; Willson, W.G. (Department of Chemistry, University of North Dakota, Grand Forks, ND). *Fuel;* **62**: No. 12, 1487-1491(Dec 1983).

To define the roles of H_2S and pyrrhotite in high temperatures employed for normal coal liquefaction, diphenylmethane hydrocracking with H_2 and H_2-H_2S was carried out with and without pyrrhotite. H_2S promotes diphenylmethane hydrocracking with H_2 both in the presence and absence of pyrrhotite, and the reaction is dependent upon the H_2S pressure in both instances. It is also dependent on the H_2 pressure when pyrrhotite is present. The results are interpreted in terms of H_2S acting as a hydrogen transfer catalyst.

45343 **Further studies of coal oxidation.** Rhoads, C.A.; Coleman, M.M.; Davis, A.; Painter, P.C.; Senftle, J.T. (The Pennsylvania State University, College of Earth and Mineral Science, University Park, PA). *Fuel;* **62**: No. 12, 1387-1392(Dec 1983).

The low-temperature oxidation of coal has been investigated by Fourier transform infrared spectroscopy (FT-I.R.). Samples

were oxidized at 140 and 60°C for intervals of a few hours to days. These FT-I.R. results were correlated to changes in the thermoplastic properties of the coal measured by a Gieseler plastometer. The loss of Gieseler fluidity as a function of oxidation time corresponds to loss of aliphatic CH groups. Curve-resolving methods were used to distinguish between various functional groups. At both oxidation temperatures there was an overall increase in carbonyl and carboxyl groups, but in different relative proportions depending on the oxidation temperatures.

45344 **Aging of SRC-II middle distillate from Illinois No. 6 coal.** White, C.M.; Jones, L.; Li, N.C. (Department of Chemistry, Duquesne University, Pittsburgh, PA). *Fuel;* 62: No. 12, 1397-1403(Dec 1983).

Individual phenolic compounds in an SRC-II middle distillate were quantified before and after aging in the presence of Cu and O_2. The concentration of each phenolic constituent decreased, indicating that they are consumed by a reaction that occurs during aging. After aging, a pentane-insoluble precipitate formed that was not present before aging. Bulk characterization of this aging product by low-voltage high-resolution mass spectrometry shows that it contains dimers, trimers, tetramers, etc., of phenols. These are the same kinds of products known to form during phenolic oxidative coupling reactions. This observation is taken as direct physical evidence that supports an earlier hypothesis that phenolic oxidative coupling reactions occur during aging of SRC-II middle distillate in Cu/O_2 environments.

45345 **High temperature alloy corrosion in coal conversion environments.** Natesan, K. (Argonne National Lab., IL). pp 336-344 of High temperature corrosion. Houston, TX; National Association of Corrosion Engineers (1983).

A review of the corrosion behavior of materials in coal gasifier environments is presented. The principal materials used in high temperature regions of coal gasification and petrochemical processing systems are iron and nickel base alloys with chromium as a major constituent. The chemistry of the gasification environment and interactions between materials and multcomponent gases are discussed. Available information was used to examine the oxidation-sulfidation behavior of commercial materials such as Incology 800 and Type 310 stainless steel and to define regimes of oxide protection in the materials as a function of oxygen and sulfur partial pressures in the gas environment.

45346 **Burn cavity growth during the Hoe Creek No. 3 underground coal gasification experiment.** Hill, R.W. (Lawrence Livermore Lab., CA). pp 364-383 of Proceedings of the 1981 international gas research conference. Rockville, MD; Government Institutes, Inc. (1982). (CONF-810909—).

From International gas research conference; Los Angeles, CA, USA (28 Sep 1981).

During the first month of the Hoe Creek No. 3 underground-coal-gasification experiment near Gillette, Wyo., analysts monitored the changing shape of the cavity with time, using three types of intruments installed throughout the experimental zone: 1) thermocouples to map temperatures, 2) extensometers to detect motions of the overburden material, and 3) high-frequency electromagnetic scans to detect cavities and zones of burning coal. A core drilling program carried out from the surface after the burn had ended provided additional data on the final shape of the underground cavity. This study of cavity-growth history has contributed significantly to understanding how the in situ coal-gasification process operates in sites like Hoe Creek.

45347 **Potential of small-scale underground coal gasification plants.** Burwell, E.L.; Wieber, P.R. pp 398-407 of Proceedings of the 1981 international gas research conference. Rockville, MD; Government Institutes, Inc. (1982). (CONF-810909—).

From International gas research conference; Los Angeles, CA, USA (28 Sep 1981).

According to an economic assessment, UCG-to-methanol plants are economically feasible on a relatively small plant scale. A 1650 ton (1500 metric ton)/day methanol plant, for example, would have cost only $145 million in January 1981 with an annual operating cost of $47 million. Furthermore, reasonably broad limits exist for matching the plant size to market needs without exceeding the limits of competitiveness. The socio-economic impacts of a new synfuel plant upon a sparsely populated community are strong enough to demand early planning of impact-mitigation procedures.

0105 By-products

REFER ALSO TO CITATION(S) 01050045347, 45368

0106 Properties

REFER ALSO TO CITATION(S) 01060045317, 45319, 45320, 45327, 45329, 45336, 45387, 45390, 46264, 46270, 46548

45348 **(ANL/FE—84-1) Sound scattering by cylindrical and spherical particles in coal slurry: theory and application.** Lin, W.H.; Raptis, A.C. (Argonne National Lab., IL (USA)). Jan 1984. Contract W-31-109-ENG-38. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017431.

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This topical report presents theory and applications of sound scattering from coal particles in hydrocarbon fluids. The theoretical solutions and numerical examples of the scattering of plane sound waves from cylindrical and spherical particles in coal/water and coal/oil slurries were investigated thoroughly, and the potential applications of the theoretical results to acoustic instrumentation for fossil-energy process were discussed. Coal/water or coal/oil slurry was considered as a viscous and thermal-conducting mixture of coal particles and hydrocarbon fluids. Sound waves propagating in coal slurries were described by linear wave equations derived from field and constitutive equations for thermoviscous fluids and thermoelastic solids and from equations of state for the media (fluids and solids separately). The normal-mode solutions to the scattering problems were obtained for cylindrical and spherical particles, and the closed forms of acoustic parameters such as scattering patterns (echoes), radiation force, scattering and abeorption cross-sections were derived in details and evaluated numerically for coal particles in water and in benzene. The ample numerical results were provided to investigate the explicit dependencies and variations of the above parameters with respect to the frequency of the wave and to the geometrical (size and shape) and material properties of coal slurries. The feasibility of applying these results to developing experimental techniques and principles of instrumentation for measuring properties or characterisitics of solid/liquid slurries was examined wherever it is suitable. The basic concept laid out in the theory, i.e., using two kinds of field equations for solids and fluids separately, is also applicable to treat two-phase (solid/liquid) flows normally existing in coal conversion pipe lines. 17 references, 17 figures, 2 tables.

45349 **(DOE/MC/08723—T1) ESR and magnetic studies of shale and coal kerogens.** Kondal, S.C.; Seehra, S.S.; Seehra, M.S. (West Virginia Univ., Morgantown (USA). Dept. of Physics). 5 Jan 1979. Contract AT21-78MC08723. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017581.

An electron spin resonance (ESR) study of five shale and two coal kerogens has been carried out 298 and 77.1°K. The ESR line shapes and linewidths, g-values and spin concentrations are determined and the data are presented in terms of H/C and O/C ratios of the samples. It is shown that the ESR linewidths are primarily determined by the interaction of the free radical spins with the hydrogen nuclear spins, suggesting that the ESR linewidths may be used to characterize the hydrogen content of the shales. Spin-spin relaxation times are determined. Magnetic susceptibility measurements on two samples (one shale and one coal kerogen) were carried out between the temperatures of 77.1 K and 298 K. It is argued that the measured susceptibilities are not due to the free radicals, but rather due to the residual mineral impurities still present in the kerogens.

45350 **(DOE/MC/19210—T1) Computed tomography of coals. Quarterly technical progress report No. 4, June 30-September 30, 1983.** Maylotte, D.H.; Kosky, P.G.; Spiro, C.L.; Lamby, E.J. (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). 1983. Contract AC21-82MC19210. 128p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84017262.

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X-ray computer tomography has been used to image the internal structures of coal samples. The samples covered a range of rank from anthracite to lignite. The images clearly showed the bedding plane alignment in the coal and areas of the coal with high mineral concentration. Calculations of CT number agree very well with experimental values and provide a basis for identifying components in the coal. Xenon gas has been used as a probe atom for the volumes of the coal accessible to the outside environment. Infusion of gas into the coal has been found to be very heterogeneous with no simple diffusion parameter to characterize it. 19 references, 68 figures, 13 tables.

45351 **(DOE/PC/60785—4) Organic oxygen characterization of coal and coal liquids. Quarterly progress report, May-July 1984.** Ehmann, W.D.; Tian, W.Z.; Prasad, M.N.; Hamrin, C.E. Jr.; Randall, D.D.; Koppenaal, D.W.; Jones, W.C. (Kentucky Univ., Lexington (USA)). Aug 1984. Contract FG22-83PC60785. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016013.

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Organically bound oxygen is one of the most abundant elements in coal, yet the amount and quality of data concerning its abundance, mode of occurrence and processing behavior are relatively lean. The rectification of this problem will require the development of appropriate methods of oxygen determination which have been lacking in the past. The stature of coal science today demands a technique for organic oxygen determination other than the outdated and error-prone oxygen-by-difference calculation. This investigation addresses this need and intends to develop methods suitable not only for total organic oxygen determination, but also for determination of oxygen functionality. The methods and techniques developed will then be applied to practical needs in characterizing the oxygen geochemistry of coal and the evaluation of coal drying on liquefaction behavior. 2 references, 3 figures, 4 tables.

45352 **(SAND—84-0209C) Rheology of direct coal liquefaction slurries during coal dissolution.** Chapman, R.N.; Lynch, A.W. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1984. Contract AC04-76DP00789. 13p. (CONF-8410134—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017152.

From 21. annual meeting of the Society of Engineering Science; Blacksburg, VA, USA (15 Oct 1984).

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We have characterized the rheology of an Illinois No. 6 coal/hydrogenated creosote oil slurry during heating from 25 to 350°C, using a novel Helical Screw Rheometer developed at Sandia National Laboratories. At shear rates at or below 140 sec^{-1}, the slurry gelled dramatically as it changed from a 10 cp power law fluid at 270°C to a 300 cp Bingham Plastic at 300°. Gelling occurs in the early stages of coal dissolution, with the slurry changing back to a low viscosity power law fluid before 50% of the coal is converted to tetrahydrofuran soluble products. The viscosity and the duration of the gel appear to be dependent on the shear history during heating. For example, at high shear rates of 790 sec^{-1}, gelling was not observed as the slurry remained a 20 cp power law fluid in the gel temperature regime. This shear effect, which was irreversible, could be used to control gelling in direct coal liquefaction processes. Data from the Helical Screw Rheometer could, for the first time, provide a technical basis for the design of coal dissolution reactors. 11 references, 5 figures.

45353 **^{57}Fe Mossbauer spectroscopic studies of fly ash from coal-fired power plants and bottom ash from lignite-natural gas combustion.** Patil, M.D.; Eaton, H.C.; Tittlebaum, M.E. (Dept. of Civil Eng., Louisiana State Univ., Baton Rouge, LA). *Fuel;* **63**: No. 6, 788-792(Jun 1984).

A series of four fly ashes, representing a variety of geological origins, and a bottom ash sample derived from the combustion of lignite-natural gas mixtures have been studied by ^{57}Fe Mossbauer spectroscopy. The ashes are separated into magnetic and nonmagnetic fractions to facilitate a study of the chemical state of the iron contained in the ash. The bottom ash contains no magnetic fraction whereas the magnetic fractions of the fly ashes range from 1.1 to 7.3%. The magnetic fractions contained iron in the form of magnetite, Fe_3O_4. Iron in the non-magnetic fly ash fractions occur as Fe^{+1} and Fe^{+2} mullites, and Fe^{+2} and Fe^{+3} silicates. Only Fe^{+3} silicates are found in the bottom ash.

45354 **Correlations between pyrolysis mass spectra of Rocky Mountain coals and conventional coal parameters.** Harper, A.M.; Given, P.H.; Meuzelaar, H.L.C. (Biomaterials Profiling Center, University of Utah, Research Park, Salt Lake City, UT). *Fuel;* **63**: No. 6, 793-802(Jun 1984).

Correlations between Curie-point pyrolysis m.s. data on 102 coal samples from the US Rocky Mountain coal province and a set of 25 conventional parameters, including ultimate, proximate, petrographic and mineralogic measurements, obtained from the Penn State Coal Data Bank were investigated using computerized multivariate statistical analysis techniques. Strong correlations were found between both data sets with regard to rank-related parameters as well as sulphur parameters, whereas moderately strong correlations exist with regard to petrographic and mineralogical parameters as well as nitrogen content. Independent factor analysis of both data matrices provides factor score plots showing remarkably similar relations between samples from different coal regions, fields and seams. In fact, up to 80% of common variance is found in the conventional and pyrolysis m.s. data sets. The large proportion of variance common to both data sets permits the calculation of numerical models which enable direct prediction of technologically important parameters such as rank, calorific value and, possibly, aromaticity from pyrolysis m.s. patterns.

45355 **Determination of functional groups of coal-derived liquids by N.M.R. and elemental analysis.** Allen, D.T.; Gates, B.C.; Gavalas, G.R.; Grandy, D.W.; Petrakis, L. (Gulf Research and Development Co., Pittsburgh, PA). *Fuel;* **63**: No. 6, 803-809(Jun 1984).

A new method of structural analysis was applied to a group of hydroliquefied coal samples. The method uses elemental analysis and N.M.R. data to estimate the concentrations of functional groups in the samples. The samples included oil and asphaltene fractions obtained in a series of hydroliquefaction experiments, and a set of nine fractions separated from a coal-derived oil. The structural characterization of these samples demonstrates that estimates of functional group concentrations can be used to provide detailed structural profiles of complex mixtures and to obtain limited information about reaction pathways.

45356 **Effect of various phenol additives on viscosity of SRC blends.** Young, L.J.S.; Li, N.C.; Yaggi, N.F. (Department of Chemistry, Duquesne University, Pittsburgh, PA). *Fuel;* **63**: No. 5, 593-599(May 1984).

Coal-derived liquids are susceptible to oxidative degradation. Two different weight ratios of SRCI/SRC-II blends, with or without phenol derivatives, have been subjected to accelerated ageing studies. Viscosity, infrared, elemental analysis, molecular weight determination, and solvent analysis are used to examine the properties of the degradation products. On ageing, there is a large increase in the amount of toluene-insoluble material, decrease in oil components, and a relatively constant amount of asphaltenes. The oxygen content increases in the aged toluene-insoluble and asphaltene fractions, and a new absorption at $\approx$ 1700 cm^{-1} (the C=0 group) appears in these two fractions only. On the addition of phenol itself and the less hindered phenol derivatives, the original hydrogen-bonding between the acidic and basic functional groups in the coal liquids is apparently disrupted because the added phenol can now interact with the proton-accepting species in the liquids, thus leading to a lower viscosity. This does not mean that the unhindered phenols retard the rate of ageing. The original hydrogen-bonding in the coal-derived liquid now gives way to a new hydrogen-bonding, and ageing occurs with the latter. The more hindered phenol de-

rivatives are not as effective as phenol in disrupting the original hydrogenbonding in the coal-derived liquids.

45357 **Direct method of determining the methane content of coal - a modification.** Smith, D.M.; Williams, F.L. (Department of Chemical and Nuclear Engineering, University of New Mexico, Albuquerque, NM). *Fuel;* 63: No. 3, 425-427(Mar 1984).

It is shown that the usually applied method for determining the methane content of coal, while quite satisfactory when used at small surface time ratios, significantly underestimates the quantity of gas lost at large surface time ratios.

45358 **Effects of diluents on the flame structure and soot concentration of synthetic fuel sprays.** Gollahalli, S.R.; Beach, V. (Combustion and Propulsion Laboratory, School of Aerospace, Mechanical and Nuclear Engineering, The University of Oklahoma, Norman, OK). pp 5-11 of Technical economics, synfuels and coal energy symposium. Dicks, J.B. New York, NY, USA; A.S.M.E. (1984). (CONF-831111—).

From ASME winter annual meeting; Boston, MA, USA (13 Nov 1983).

Experimental results on the effects of inert diluents on the flame structure and soot concentration of burning airblast atomized liquid sprays are presented. A petroleum-derived liquid (No. 2 oil), a shale-derived liquid (DFM), and two samples of coal-derived liquids (SRC-II) were used as fuels. Air, carbon dioxide, and nitrogen were used as the atomizing gas. The results indicate the use of diluents in the atomizing stream, although decreased soot formation rate, does not affect its liberation from the flame significantly.

45359 **Analysis of pulverized coal particles (10-100 μm) for Fe, S, Ca, Si and Al on a particle-by-particle basis.** Moza, A.K.; Austin, L.G. (Department of Materials Science and Engineering, The Pennsylvania State University, University Park, PA). *Fuel;* 62: No. 12, 1468-1473(Dec 1983).

A computer controlled scanning electron microscope fitted with soft X-ray fluorescence analysed thousands of pulverized coal particles in the size range 10 to 100 μm for amounts of Al, Si, Ca, S and Fe in each of the particles. Two coals were used, namely, subbituminous C, Comanche-Wyoming and subbituminous B, Rosebud-Montana. In pulverized coal combustion Rosebud coal has a bad slagging record not predictable from conventional slagging indices based on the elemental analyses of the total coal ash. The coal particles were placed into one of four groups: little mineral matter; low melting point inorganic composition; high melting point compositions; and large amounts of iron or pyrite. On this basis, Rosebud coal had 47% of its mineral matter in groups likely to cause slagging compared with 12% for Comanche coal, in agreement with the slagging record. It is concluded that although the particle-byparticle analysis technique used here is in a crude state of development, it can give a correct indication of the possible slagging behavior of a pulverized coal in cases where conventional slagging indices based on the analysis of the total mean coal ash fail to give the correct indication.

45360 **Hydrogen mass transfer in liquid hydrocarbons at elevated temperatures and pressures.** Kara, M.; Chiang, S.H.; Klinzing, G.E.; Sung, S. (Chemical and Petroleum Engineering Department, University of Pittsburgh, Pittsburgh, PA). *Fuel;* 62: No. 12, 1492-1498(Dec 1983).

The mass transfer rate of hydrogen in tetralin and hydrogenated SRC II liquid was studied in a stirred vessel at 606-684 K and 7.0-13.5 MPa. Experiments were carried out using a newly developed in-situ hydrogen probe made of semi-permeable nickel membrane. The effects of stirrer speed, liquid height to vessel diameter ratio, temperature and pressure on mass transfer rate coefficients were investigated. The experimentally determined k /SUB L/ a values were correlated in terms of power input per unit volume of liquid and liquid height to vessel diameter ratio. Furthermore, the liquid-phase mass transfer coefficient, k /SUB L/, was found to be of the order of 10^{-5} m s^{-1} for low agitator speeds.

45361 **Incorporation of quinoline into coal and coal-derived products.** Narain, N.K.; Appell, H.R.; Blaustein, B.D.; Utz, B.R. (US Department of Energy, Pittsburgh Energy Technology Center, Pittsburgh, PA). *Fuel;* 62: No. 12, 1417-1421(Dec 1983).

Quinoline forms an adduct with Bruceton hvAb coal at temperatures <250°C in absence of H_2 pressure and catalyst. The extent of quinoline incorporation into Bruceton coal was both time and temperature dependent. After 4 h at 200°C, 20 wt% of quinoline had incorporated into the coal, as indicated by solubility measurements. A dissolution-precipitation technique was employed to permit a clean separation of physically-entrapped quinoline from the crude adduct. The crude adduct isolate in the first precipitation step had about 75% of its quinoline content physically entrapped and 25% chemically bound, presumably by hydrogen bonding to acidic centers.

0108 Waste Management

45362 **(DOE/MC/08704—T1) Biological treatability of gasifier wastewater. Final report.** Sack, W.A. (West Virginia Univ., Morgantown (USA). Dept. of Civil Engineering). 4 Jun 1979. Contract AT21-77MC08704. 117p. NTIS, PC A06/MF A01; GPO Dep. File Number DE84017560.

The objective of this research was to evaluate the amenability of biological treatment of wastewater from the gasifier (coal gasification) unit operated by the Morgantown Energy Technology Center. The general approach used in this work was to develop a biomass acclimated to the gasifier wastewater and then make a series of runs at various organic loading rates and detention times to develop performance and design parameters. In Series A, a set of preliminary runs was carried out to examine the influence of dilution and detention time on performance. A second set (Series B) of experiments was undertaken to assess a combined biological-physical system with powdered activated carbon added directly to the biological reactors. An amendment was made to the original contract for this purpose. Finally, based on the results of Series A, a more extensive series (Series C) of continuous flow runs was made to develop kinetic data. 40 references, 25 figures, 21 tables.

45363 **(DOE/MC/08718—T1) Wet oxidation of waste water from coal gasification plant with net mechanical energy recovery. Final report.** Verhoff, F.H.; Chou, C.L. (West Virginia Univ., Morgantown (USA). Dept. of Chemical Engineering). 1978. Contract AT21-77MC08718. 75p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017585.

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This project involved the investigation of the wet oxidation process for the treatment of waste waters from coal gasification plants and the use of the waste water for the generation of mechanical energy. Experimentally, it is necessary to measure the oxidation rate of the waste water in a wet oxidation reactor. Although it was hoped to obtain experimental data during the first year of the project, problems with the acquisition of equipment prevented assembling the experimental apparatus. The calculational part of the project involved mass and energy balances on different wet oxidation processing schemes for the generation of power. This report contains the investigation of three such schemes; two of which have been reported in the literature previously. The third scheme is a novel approach to power generation using a high temperature compressor which eliminated the condensation problems in the turbines. The calculations indicate that this third scheme is superior to other methods for energy generation from wet oxidation processes. For example, it shows that a COD of 8000 mg/ml is sufficient to generate power for the new scheme at 1500 psia whereas 20,000 is required for the old power generation schemes. The efficiency calculated for the new scheme approaches 24% conversion to useful power whereas the old schemes had a conversion efficiency of about 10%. It is concluded that a patent of this new process should be obtained. 12 references, 15 figures, 5 tables.

45364 **(DOE/METC—84-26-Vol.1) Failure mode analysis for lime/limestone FGD systems. Volume 1. Description of study and analysis of results.** Kenney, S.M.; Rosenberg, H.S.; Nilsson, L.I.O.; Oxley, J.H. (Battelle Columbus Labs., OH (USA)). Aug 1984. Contract AT02-80CH92122. 267p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE84011958.

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Objective was to improve the reliability of lime/limestone FGD (flue gas desulfurization) systems by identifying the root cause of failure in full-scale installations so that recommendations for remedial measures could be made to system users. A systematic approach for determining FGD system failure causes and potential solutions were developed based upon past experience in field reliability studies. Visits were made to 37 utility sites which included 61 separate FGD systems to collect data for the reliability analysis. The FGD subsystems causing the most amount of downtime at the system and plant levels (rather than the module level) are ductwork, stacks, thickeners, and pipes and valves. The most troublesome failure modes for these key subsystems are acid attack of stack linings and corrosion of outlet ducts. The sulfur and chloride content of the coal affect FGD system reliability; reliability decreases as the sulfur or chloride content increases. For reliability purposes, FGD system designs should exclude subsystems that are nonessential for operation. Spare modules are recommended because they reduce the effects of failures on overall system operation. Subsystems with high failure rates (e.g., pumps) or major failure effects (e.g., outlet ducts and flues) should be considered as candidates for redundancy. Future studies should concentrate on the subsystems with the key failure modes: stack linings and outlet ducts.

45365 **(DOE/METC—84-26-Vol.2) Failure mode analysis for lime/limestone FGD systems. Volume II. Trip reports and analysis of results.** Kenney, S.M.; Rosenberg, H.S.; Nilsson, L.I.O.; Oxley, J.H. (Battelle Columbus Labs., OH (USA)). Aug 1984. Contract AT02-80CH92122. 344p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE84012007.

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Results of visits to 39 utility power plants to assess the flue gas desulfurization system reliability are reported. (DLC)

45366 **(ERP/MSL—83-121(TR)) Sulphation capacity of Swedish carbonate rocks.** Hamer, C.A. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Mineral Sciences Lab.). Sep 1983. 18p. Department of Energy, Mines and Resources, Mineral Sciences Labs., Ottawa, Ontario, Canada.

Eight carbonate rocks, which had been evaluated as SO/SUB/2 sorbents by the thermogravimetric analysis method at the Chalmers University of Technology, Goteburg, were evaluated at CANMET in a bench scale fluidized bed reactor. Although the absolute values of the sulphation capacity were different for the two methods (the reactor results being lower), the ranking of the carbonate rocks was identical.

45367 **(ESG—3519) Advanced combined NO/sub x//SO/sub x/ removal system. Monthly technical progress report, June 30, 1984-July 27, 1984.** (Rockwell International Corp., Canoga Park, CA (USA). Rocketdyne Div.). 1984. Contract AC22-83PC60262. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016293.

During this reporting period, task 3, system modifications continued. The new Moving Bed Contactor/Filter facility has been relocated to a new laboratory with greater head space. A new structural framework was built and the installation of the new vessel was completed. Power for the three zones of heaters is being installed in the new facility. The design, fabrication, and installation of a suitable shaft seal, bearings, and dust seal for the L-valve screw feeder concept (described in last month's report) was also completed. The fabrication of new internals for the contactor/filter is in progress for greater bed thickness. In Tasks 1 and 2, seven catalysts were screened and characterized using a small fixed bed to test their performance. Small quantities of catalyst were prepared in the laboratory for this purpose. Catalyst 100 (prepared from Davison SMR 7-6300 support) gave the best overall performance in terms of NO/sub x//SO/sub x/ removal and attrition resistance. The next phase of the program, i.e., tests in the moving bed contactor/filter, requires about 400 pounds of the catalyst. This large quantity of material will be prepared commercially by Davison Division of Grace. Since the commercial preparation technique differs slightly from the laboratory preparation method, Davision has prepared a small batch of catalyst for evaluation in our laboratory fixed-bed apparatus. Tests of this sample of commercially prepared material indicated its performance was similar to the laboratory prepared catalyst and Grace is now proceeding with the manufacture of a 400-pound lot. Results of the tests of the commercial sample are discussed. 4 figures, 1 table.

45368 **(IMMR—82-065) Proceedings: seventh Kentucky coal by-products seminar.** Rose, J.G. (ed.). (Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research). Jan 1982. 43p. (CONF-8106333—). University of Kentucky, Inst. for Mining and Minerals Research, Lexington (USA).

From 7. IMMR Kentucky coal by-products seminar; Lexington, KY, USA (12 Jun 1981).

Papers are presented on the use of fly ash as a raw material in the cement industry. They consider the management of an effective ash marketing program, the use of ash in a structural fill, the use of fly ash in concrete, and the quality control of fly ash during the combustion process. The four papers are abstracted separately.

45369 (IMMR—82-065, pp 1-6) **Effective ash marketing program, utility management's responsibility.** Covey, J.N. Jan 1982. University of Kentucky, Inst. for Mining and Minerals Research, Lexington (USA). (CONF-8106333—).

From 7. IMMR Kentucky coal by-products seminar; Lexington, KY, USA (12 Jun 1981).

An ash marketing program is suggested to reduce power plant costs which result from the disposal of fly ash and bottom ash. Ash is not a waste product from electric generation but a recoverable resource which can provide a profit to the utility. Instead of paying for disposal sites, management should be marketing ash, large volumes of which are used in the concrete industry. The utilization of ash in this way also solves the environmental problems of its disposal.

45370 (IMMR—82-065, pp 7-11) **Engineering approach for using power plant ash in a structural fill.** Kinder, D.L.; Morrison, R.E. Jan 1982. University of Kentucky, Inst. for Mining and Minerals Research, Lexington (USA). (CONF-8106333—).

From 7. IMMR Kentucky coal by-products seminar; Lexington, KY, USA (12 Jun 1981).

An engineering approach to the utilization of fly ash in large tonnage structural fill applications is put forward based on actual field experience. This large volume use of fly ash is likely to be important for the next decade, at least.

45371 (IMMR—82-065, pp 12-21) **Quality control of a fly ash - the combustion process.** Styron, R.W. Jan 1982. University of Kentucky, Inst. for Mining and Minerals Research, Lexington (USA). (CONF-8106333—).

From 7. IMMR Kentucky coal by-products seminar; Lexington, KY, USA (12 Jun 1981).

The utilization of fly ash from coal-fired electric generating stations is discussed. In particular it has been used as a material in portland cement concrete. Specification requirements, both chemical and physical, are considered, and the effects of malfunctions in the combustion process on the quality of the fly ash are discussed. The optimum combination of fly ash, cement and water is calculated, and different uses of the concrete are indicated. (2 refs.)

45372 (IMMR—82-065, pp 22-29) **Utilization of fly ash in concrete.** Ashby, J. Jan 1982. University of Kentucky, Inst. for Mining and Minerals Research, Lexington (USA). (CONF-8106333—).

From 7. IMMR Kentucky coal by-products seminar; Lexington, KY, USA (12 Jun 1981).

The use of fly ash in concrete is discussed. This includes consideration of fly ash availability, specifications for fly ash for use in concrete, guidance on use, effects of fly ash on the properties of concrete, and quality control of fly ash. (22 refs.)

45373 **Calcium silicates: a new class of highly regenerative sorbents for hot gas desulfurization.** Yang, R.T.; Shen, M.S. (Brookhaven Natl. Lab.). *AIChE (American Institute of Chemical Engineers) Journal;* **25**: No. 5, 811-819(Sep 1979).

A thermodynamic and kinetic study on the use of calcium silicates and silica-supported lime as regenerative sorbents for desulfurization of hot combustion gases showed that, except for γ-Ca_2SiO_4 and Ca_3SiO_5, all the calcium silicates and the silica-supported calcium oxide were as reactive as, or more reactive than, calcium oxide. The regeneration rates of these sorbents were substantially higher than that of calcium oxide, the rate of thermal decomposition of the sulfated mono- and dicalcium silicates being about 15 times higher than that of calcium sulfate. Sulfation rates of $CaSiO_3$ and Ca_2SiO_4 were first order with respect to sulfur dioxide only for partial pressure of sulfur dioxide '3; 3000 ppm. The silica-supported calcium oxide after heat treatment at 1075°C had β-$CaSiO_3$ on its surface.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 01090045316, 46349, 46744, 46788

45374 (LMF—107, pp 377-380) **Health risks from the disposal of solid FBC wastes in the environment.** Seiler, F.A. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

Estimates are made for potential health hazards from deposition of solid fluidized bed combustor wastes in the environment. Environmental dilution factors are estimated on the basis of model assumptions and measurements of equilibrium leachwater concentrations. Upper limits for annual cancer fatalities from drinking water contamination with trace elements are given. No estimates for endpoints other than cancer or for leached hydrocarbon compounds are made.

45375 **(PB—84-178672) Surface coal mine spoil stability study: Eastern coal province. Volume 1. Open file report 20 Apr 79-25 Aug 83.** Swanson, P.G.; Giese, J.C.; Jones, J.S. Jr. (Law Engineering Testing Co., McLean, VA (USA)). 25 Aug 1983. 170p. NTIS, PC A08/MF A01.

The objective of this project was to quantitatively assess the slope stability problems associated with coal surface mining in the eastern coal province and to recommend spoil placement techniques that provide for slope stability. Data were collected from 11 mine sites in Alabama, Kentucky, Ohio, Pennsylvania, Tennessee, and West Virginia. A site was selected in each of the six States on which a detailed investigation was conducted. The investigations included drilling through the slide into solid ground beneath, collecting samples at various depths for identification, and for laboratory tests. A topographic survey and field monitoring was conducted to determine field conditions at each slide.

45376 **(PB—84-178680) Surface coal mine spoil stability study: Eastern coal province. Volume 2. Open file report 20 Apr 79-25 Aug 83.** Swanson, P.G.; Giese, J.C.; Jones, J.S. Jr. (Law Engineering Testing Co., McLean, VA (USA)). 25 Aug 1983. 352p. NTIS, PC A16/MF A01.

The objective of this project was to quantitatively assess the slope stability problems associated with coal surface mining in the eastern coal province and to recommend spoil placement techniques that provide for slope stability. Data were collected from 11 mine sites in Alabama, Kentucky, Ohio, Pennsylvania, Tennessee, and West Virginia. A site was selected in each of the six States on which a detailed investigation was conducted. The investigations included drilling through the slide into solid ground beneath, collecting samples at various depths for identification, and for laboratory tests. A topographic survey and field monitoring was conducted to determine field conditions at each slide.

45377 **(PB—84-178698) Surface coal mine spoil stability study: Eastern coal province. Manual of practice. Open file report 20 Apr 79-25 Aug 83.** Swanson, P.G.; Giese, J.C.; Jones, J.S. Jr. (Law Engineering Testing Co., McLean, VA (USA)). 25 Aug 1983. 42p. NTIS, PC A03/MF A01.

This manual of practice is to be used in combination with volumes I and II of the study on spoil stability in the eastern coal province. The manual applies the predictive matrices developed in the parent study for use in evaluating the stability of typical mine spoil slopes. The values of internal friction and pore pressure coefficient are derived for many varied slope conditions. The results can be used in conventional stability analysis equations to assist mine operators or regulatory personnel in evaluating spoil stability from very limited information.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 01100045384

45378 **(DOE/ET/14692—T7) Inventory of peat resources: an area of Beltrami and Lake of the Woods counties, Minnesota.** (Minnesota Dept. of Natural Resources, St. Paul (USA). Div. of Minerals). 1984. Contract FG18-79ET14692. 83p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84015824.

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This report presents the findings of the Minnesota Peat Inventory Project's (MPIP) reconnaissance-level survey of an area of Beltrami and Lake of the Woods counties. Peatlands cover about 314,000 hectares (775,000 acres) of this area and constitute about 12 percent of the state's total peat resource. The survey identifies the location and amount of fuel-grade and horticultural peat in the two county area. The report provides a general discussion of peatlands and describes the field and laboratory procedures of this peatland survey and presents a map of the peat resources in the surveyed area. 28 references, 12 figures, 12 tables.

0120 Mining

REFER ALSO TO CITATION(S) 01200045375, 45376, 45377, 46448

45379 **(BM-RI—8795) Problems facing coal mining and gas production in the Hartshorne coalbeds of the Western Arkoma Basin, OK.** Iannacchione, A.T.; Kertis, C.A.; Houseknecht, D.W.; Perry, J.H. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1983. 141p. GPO. File Number TI84901779.

Major problems facing the development of coal and gas resources of the Hartshorne Coalbeds include the complex distribution of minable and unminable coal, high methane content and bed pressure, faulting, variations in degree of dip, presence of natural gas fields in associated sandstones, and legal problems, caused by local geologic characteristics, in identifying gas origin. This Bureau of Mines study provides pertinent geologic information for long-range planning of subsurface coal and gas production from the Hartshorne Coalbeds. Pittsburg, Coal, Hughes, and Atoka Counties, OK, have approximately 1 billion metric tons (1.1 billion short tons) of Hartshorne coal in place. The methane resource of Hartshorne Coalbeds is estimated at 9.2 billion m^3 (325 billion ft^3) and varies with overburden and rank. These estimates were compiled from gas well density logs, coal-core data, outcrop measurements, abandoned mine maps, and the literature. The Hartshorne Coal beds represent a valuable coal and gas resource which at present is contributing nothing to coal and gas production. This report discusses potential problems and serves as a reference for future exploration and development work. Recognition of these potential geologically related problems prior to development of this basin will reduce hazards and allow for an economic recovery of these resources. 33 references.

45380 **(DOE/FE/00016—T56) Refinement and evaluation of basic longwall dust-control techniques. Twenty-eighth monthly technical letter report, August 1984.** Kost, J.A. (Bituminous Coal Research, Inc., Monroeville, PA (USA). National Lab.). 06 Sep 1984. Contract AI01-81FE00016. 2p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016959.

The objective is to evaluate the effectiveness of available dust-control technology for double-drum shearer longwall sections. A preliminary visit was made to Harris No. 2 Mine, Eastern Associated Coal Corporation, on August 9, 1984, to assess the suitability of the longwall panel and shearer drums for a comparison of the dust-control effectiveness of Thru-flush bits and pick-face-flushing vane-mounted sprays. The section and drums were found acceptable and sampling began August 15, 1984. The sampling program consisted of two distinct test periods for each spray system (A-B-A-B) and was completed on August 28, 1984. A total of 17 cutting passes was sampled with the Thru-flush bits and 19 cutting passes were sampled with the vane sprays. Preliminery analysis of the data has begun. For the first test period with Thru-flush bits, the average perpass dust levels for H → T cuts at the shearer and tailgate sampling locations were 5.4 mg/m³ and 7.9 mg/m³, respectively. The average water flow to the shearer was 42.4 gpm at a water pressure of 225 psi, as measured with the BCRNL water meter installed in the shearer line just inby the water filter at the stage-loader. The water pressure at the drum spray nozzle was checked and found to be 45 psi, with all shearer water sprays operating.

45381 **(NP—4770364) Theoretical and experimental investigations of the use of a stowing material solidified by a binder in coal mining.** Helms, W. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 2 Jul 1982. 206p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE84770364.

Investigations at washery refuses of a coal mine of the Ruhr region with and without the addition of a binder were carried out in order to judge the demands and the properties of the used stowing material during the longwall mining of steep coal seams. The important material properties of the stowing material which determine the behaviour during the compaction are the petrographical composition, the grain shape distribution, the grain size distribution and the moisture. The washery refuses consolidated by cement and the fresh stowing mixtures were studied with respect to the determination of the influencing factors on the pressure resistance.

45382 **(NP—4770380) Contribution to the short-circuit rapid switch-off in low voltage mains of underground coal mines.** Schenke, G. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Elektrotechnik). 4 Dec 1981. 140p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84770380.

Investigations about the short circuit protection for underground low-voltage mains in which the arc formation is prevented and which are economically feasible were carried out. The demands to the short circuit protection in particularly endangered points yielded that the duration of the short circuit may be maximally 10 ms for short circuit currents of Isub(K) > 2 kA. A phase-sensitive short circuit protection and a corresponding device were developed for the detection of low short circuit currents.

45383 **(NP—4770394) Report on the activities of the mining authorities of Northrhine-Westphalia in 1982.** (Ministerium fuer Wirtschaft, Mittelstand und Verkehr des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.)). 1983. 98p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84770394.

Both to the mining authorities and to the mining industry, the coming into effect of the Federal Law on Mining in the beginning of the report period 1982 was of significant importance. With this law, for the first time in the Federal Republic, a uniform mining law replaced the Laender regulations which had differed strongly from each other. Introduction of the new law and applying it practically had been possible only after intensive consultations with the other Laender authorities and the mining industry and were found to be very time-consuming and needing great efforts. The classical tasks of mining control, pit safety, and health protection were not neglected as can be seen from the still favourable development of accidents and occupational diseases. The report gives an extensive report on this and also on the other tasks and activities of the mining authorities.

45384 **(NP—4901881) Engineering study of coalbed degasification in the Warrior Basin of Alabama.** Wang, G.C.; Tsay, F.S.; Dharwadkar, S.R. (Alabama Univ., University (USA). School of Mines and Energy Development). [1984]. 103p. NTIS, PC A06/MF A01. File Number DE84901881.

This project was an engineering study of coalbed methane extraction in the Warrior Basin of Alabama. The coal lithology logs and the production histories of major degasification fields in the Warrier Basin were studied in detail. A comparative analysis of gas and water production of different wells was conducted to evaluate open hole completions and through-casing completions. A similar analysis was made to evaluate different stimulation techniques. Attempts were made to evaluate the relations between the uncemented portions. Logs from The University of Alabama's corehole program and the production well were analyzed. Laboratory experiments were conducted to establish the porosities and permeability of the cores obtained from zones adjacent to the producing zones of the University's production well. The results indicated that the water would be much lower, unless fractures have propagated into these zones. The results of water analysis show no indication of freshwater channeling. An experiment has been proposed to make a comparative evaluation of different stimulation techniques. A preliminary study has been completed to explore the possibility of using chemicals for increasing permeability in coal. Further research in this area might result in significantly improving methods for stimulation of these coal seams. 29 references, 19 figures, 5 tables.

45385 **Coal seam methane drainage by hydraulic fracturing providing the methane for energy while enhancing mining safety and efficiency.** Hanson, M.E.; Trevits, M.A.; Towse, D.F.; Thorson, L.D. (Lawrence Livermore National Lab., CA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **17**: vp(1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Paper 829180.

The principal coalbed parameters controlling the geometry of hydraulic fractures created to enhance methane drainage are the in situ stress characteristics and the friction along existing joints and parting planes. Researchers are currently testing these parameters to see if hydraulic fractures can be contained entirely within the coal. The tests involve in situ stress measurements at three stimulated wells and studying the mechanical properties and frictional characteristics of mine samples. As the region is mined, the researchers will be able to observe the actual hydraulic fracture geometry, thus validating their predictions and their understanding of the controlling parameters.

45386 **Comparative economics of vertical wells and in-mine boreholes for coal-bed methane drainage.** Gillies, A.; Gabello, D.P.; Shoemaker, H.D. pp 540-549 of Proceedings of the 1981 international gas research conference. Rockville, MD; Government Institutes, Inc. (1982). (CONF-810909—).

From International gas research conference; Los Angeles, CA, USA (28 Sep 1981).

To degasify deep coal reserves, operators can choose between initiating a vertical-well drainage program in advance of mining or conducting an in-mine horizontal-borehole operation in parallel with mining. When analysts compared these alternatives for predraining a large longwall mine, they concluded that the vertical-well system could produce a much higher rate of return. This advantage accrues solely from the longer lead times for investments and revenues when considered on a discounted-cash-flow basis. If predrainage is necessary, operators should act as early as possible to maximize the returns on their drainage investments.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 01300045326, 46433

45387 (DOE/MC/20700—1635) Manufacture and testing of ultra-clean coal/water mixture fuel for gas-turbine applications. Final report. Bhasin, A.K.; Smit, F.J.; Anast, K.R.; Doane, R.E. (Amax Extractive R and D, Inc., Golden, CO (USA)). 20 Aug 1984. Contract AC21-83MC20700. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017566.

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AMAX Extractive R and D manufactured, on a pilot-plant scale, two 250-gallon lots of clean and ultra-clean coal-water slurry fuel for DOE programs to develop coal-fueled direct-fired gas turbines. Both lots were prepared from high-volatile bituminous coal ground to pass 44 micrometers. The first lot, containing 1.95% ash, represented fuel manufactured with available coal cleaning technology. Advanced chemical coal cleaning technology was employed to prepare the second lot of ultra-clean coal-water mixture containing 0.4% ash. A conceptual design study was made for a coal processing plant to produce 1.7 million tons per year of ultra-clean coal-water mixture fueling a 500-MW gas-turbine generating station. The capital cost was estimated to be $227 million and the production cost was projected to be $5.16 per million Btu. Additional work is needed to refine these costs and to develop relationships between cost and fuel quality. 25 references, 17 figures, 17 tables.

45388 (NP—4901789) Development program for producing clean pellet fuel from Ohio coal. (McDowell Wellman Engineering Co., Cleveland, OH (USA)). Aug 1979. 243p. Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216-1001. File Number TI84901789.

This program concerned the development of a new pelletizing process for converting a blend of coal and limestone into a clean pellet fuel (Helifuel). Processing involved grinding and blending coal, limestone, and additives followed by balling and high temperature firing using a Dwight-Lloyd traveling grate processing system. During firing operations the pellets become hardened, depleted of volatile matter, and have sulfur primarily fixed to the ash constituents of the coal. Two species of processing, carbonizing and pyrolyzing, were investigated as a series of more than 240 bench scale tests. More than 30 pilot plant test runs were performed as materials balance operations using the carbonizing process. Five different Ohio coals having 2 to 4 percent sulfur were tested in the scope of the bench scale work and three of these were extensively tested in the pilot plant phase of activity. Favorable processing techniques have been developed for production of Helifuel. A practical flowsheet which uses well-developed metallurgical equipment was applied and the process appeared to be environmentally acceptable. Extensive sulfur fixation during processing was evident wherein the pilot plant tests showed that emissions of less than 0.6 lb. S/MMBtu were attainable in the exhaust gas streams. Low emissions of NO/sub x/ and particulates were also noted. Small scale combustion and gasification tests indicated clean pellet fuel to have satisfactory properties with respect to utilization and environmental control. The capability of having gaseous products of combustion free of visible emissions containing less than 0.6 lbs. S/MMBtu was demonstrated. The data from this program serve as satisfactory bases of (1) commercial product evaluation tests and (2) commercial or semicommercial (demonstration) plant design.

45389 (TR—63) Design of a fluid-dynamic injector for the atomization of a coal-water slurry with superheated steam. Final report. Loth, J.L.; Smith, J.E.; Lechnar, M. (West Virginia Univ., Morgantown (USA). Dept. of Aerospace Engineering). 1977. Contract AT21-77MC08703. 56p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017561.

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One aspect of the problem of drying a high pressure coal slurry with superheated steam has been investigated. A coal slurry atomizer was designed which allowed a rapid dispersion and drying of the coal particles without time for agglomeration. The Morgantown Energy Research Center staff has used this design to construct and test this slurry atomizer and found it to function satisfactorily. The scaling effect of this atomizer has been theoretically analyzed and appears to present no problems. The theoretically anticipated drying time has been computed and is given herein. 42 references, 15 figures.

45390 Characterization of fine coal particles by steric field-flow fractionation. Graff, K.A.; Caldwell, K.D.; Giddins, J.C.; Meyers, M.N. (Department of Chemistry, University of Utah, Salt Lake City, Utah). *Fuel;* 63: No. 5, 621-626(May 1984).

Steric field-flow fractionation (steric FFF) is described as a method for the separation and characterization of particulate materials of particle diameter >1 μm. The theoretical basis of steric FFF is described and the concept of apparent particle radius is introduced. Experiments are described using coal ground to a few μm mean diameter. Fractionation is demonstrated by collecting fractions and reinjecting them into the device, after which they reemerge in a position close to that of the original fraction. A size-distribution curve is obtained and compared to those generated by other means. Possible sources of discrepancies are described. The advantages and potential applications of steric FFF to process control and coal research are discussed.

45391 Instrumentation and monitoring. O'Fallon, N.M. (Argonne National Lab., Argonne, IL). pp 611-657 of The science and technology of coal and coal utilization. Cooper, B.R.; Ellingson, W.A. New York, NY, USA; Plenum Press (1984).

This chapter examines the types and uses of instrumentation in advanced coal utilization systems and the special difficulties in making instruments operate in the hostile conditions present in advanced coal systems. Each major process variable (flow, temperature, composition, etc.) is then considered and surveyed for available and developmental instrumentation to monitor that variable, describing the principle of operation, limitations and major problems associated with use of that instrument, and the current status of the instrument. Topics covered include multiphase flow measurement, temperature measurement, gas stream analysis, particulate monitors, solid and slurry stream analysis, level detection, and nondestructive evaluation instruments. Diagnostic instrumentation, safety instrumentation, process control and optimization instrumentation, and environmental control instrumentation are investigated. Difficulties in instrumenting coal utilization systems stem from the extremely hostile conditions in which the instruments must operate and from the complexity or ambiguity involved in interpreting readings on a multiphase medium.

45392 Effect of fracture modes on shape and size of coal particles and separation of phases. Lytle, J.M.; Bunnell, L.R.; Prisbrey, K.A. (Battelle, Pacific Northwest Laboratory, Richland, Washington). *American Chemical Society, Division of Petroleum Chemistry, Preprints;* 28: No. 5, 1203-1207(Sep 1983). (CONF-830814—).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

Studies of coal grinding are becoming one of the most important and interesting areas of coal research. Consequently, the Department of Energy sponsored "Study Group on Research Planning for Coal Utilization and Synthetic Fuel Production" emphasized size-dependent phenomena during coal grinding as one of the seven most important areas of research needed for development of an advanced coal and synfuels industry. Nearly every use of coal involves grinding to some extent and modern processes are requiring finer and finer coal powders. Knowledge of the properties of these coal powders is essential in developing these processes. For example, knowledge of shapes and sizes of particles is important in defining the viscosity and transport behavior of coal-liquid slurries for combustion or pipeline transport. Knowledge of separation of phases is important in developing beneficiation processes to remove impurities. The study reported in this paper used microscopy, shape, size and sulfur analyses to show the influence of fracture modes and mechanisms on shape and size of coal particles and separation of phases. The preferential lines of fracture during coal grinding were identified microstructurally and related to the size and shape of particles produced and the separation of mineral and

organic phases. For example, weaker phases that were lean in organic sulfur were observed to concentrate into finer particle size ranges and stronger phases that were rich in organic sulfur concentrated into coarser particle size ranges.

0140 Combustion

REFER ALSO TO CITATION(S) 01400045312, 45337, 45388, 46169

45393 **(ANL/FE—83-22) Application potential of advanced instrumental methods for on-line automated composition analysis of solid/liquid fossil energy process materials. Volume 2. Non-nuclear methods.** Herzenberg, C.L. (Argonne National Lab., IL (USA)). Mar 1984. Contract W-31-109-ENG-38. 113p. NTIS, PC A06/MF A01; GPO Dep. File Number DE84017432.

A study has been conducted to identify and examine potential novel on-line techniques for analysis of condensed phase material in coal process streams and vessels for fossil energy applications. This portion of the study (Volume II) deals with the potential of techniques based on non-nuclear principles for sensor development for analytic applications. A companion volume deals with nuclear methods. The study has encompassed methods in use in basic and applied research, as well as methods in use in other industries including the basic metals industry, mining, well-logging for petroleum and other applications, and methods used for biomedical applications. Applicability to the fossil energy industry (primarily coal combustion and conversion applications) has been emphasized in the present study. The results are reported in the accompanying text in which non-nuclear techniques have been identified for their potential for use or for improvements in use for on-line sensors for the fossil energy industry. 583 references.

45394 **(BNL—51796) Feasibility of utilizing a rotating fluidized bed for the removal of sulfur from hot gases.** Waide, C.H.; Chua, J.O.; Saunders, J.H. (Brookhaven National Lab., Upton, NY (USA)). Aug 1983. Contract AC02-76CH00016. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017168.

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An experimental program was performed to evaluate the feasibility of removing SO_2 from combustion product gases using a rotating fluidized bed containing limestone. Operation of this unique device at 850°C was accomplished and SO_2 reductions from 4000 to 6000 ppM down to approximately 100 ppM or less were observed in the hot exit gas stream at gas velocities up to 8 fps. The concept is presented as an alternative to the conventional fluidized bed combustor where desulfurization and combustion occur simultaneously but at conditions optimizing the desulfurization process rather than the combustion reaction. Both sorption and entrainment studies are reported. 10 references, 37 figures, 3 tables.

45395 **(DOE/ET/10511—T1) Analysis of the vertical kiln production of natural cement.** Killmeyer, D. Jr.; Wright, D. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Civil Engineering). 1978. Contract FG01-77ET10511. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017589.

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In this project studies were carried out on various aspects of producing cement using a vertical kiln process. Using results from tests performed on the process and on the materials involved, analyses were performed in two major areas. These areas included energy considerations and the economic feasibility of this method. In terms of energy the vertical kiln process is a very sound idea. Whereas in the manufacture of Portland cement large amounts of natural gas are consumed, the fuel for this natural cement is low Btu coal. This fact could prove to be especially important if natural gas can be freed for other purposes for which coal is not a substitute. Natural cement is also an economically feasible alternative to Portland cement. Due to lower energy costs natural cement is substantially less expensive to produce. Although the product does not attain the ultimate strength nor have the consistent quality of Portland cement, its overall lower cost could offset this disadvantage in areas where high strength is not required. As the project progressed, many unforeseen difficulties arose. These mainly involved the actual firing of the kiln used in converting the raw materials into natural cement. As a result, much time was spent in the preparation of materials and equipment. The prepared material was burned manually, outside of the kiln and the resulting product was then analyzed by x-ray diffraction. The analysis proved that a form of cement was indeed made, and that the vertical kiln method is quite feasible.

45396 **(DOE/MC/11448—T1) Reactions of alkali metal containing species in combustion processes. Final technical report.** Stewart, G.; Conner, C.; Chakrabarti, A.; Nesbitt, F.; Moore, W.R. (West Virginia Univ., Morgantown (USA). Dept. of Chemistry). Feb 1981. Contract AT21-79MC11448. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017587.

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To fully characterize a coal conversion stream, it is necessary to identify both the composition of the stream and chemical processes responsible for the production of the stream components. During the past year, studies have focused on the release of alkali-containing species, the release of sulfur-containing radicals, and the production of ionic species in a combustion stream. Transpiration mass spectrometry was used to study the thermal decomposition of alkali benzoates. The vaporized species at temperatures greater than 800°C were atomic alkali and CO. This is consistent with earlier DTA-TGA studies. Efforts to develop sources of sulfur-containing radicals continued. The SF_2 radical was identified for the first time as a product of the $H_2S + F_2$ reaction. Under certain conditions, the $H_2S + F_2$ reaction entered an oscillatory region. Finally, the study of ion-molecule reactions in a combustion flame was initiated. The ion-cyclotron resonance spectrometer was characterized by studying the methane system. 26 figures.

45397 **(ERP/ERL—81-55(TR)) Description of the Mark II atmospheric fluidized bed combustor at the Canadian Combustion Research Laboratory.** Hector, D.R.; Desai, D.L.; Friedrich, F.D.; Anthony, E.J. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Energy Research Labs.). Aug 1981. 32p. Department of Energy, Mines and Resources, Energy Research Labs., Ottawa, Ontario, Canada.

The facilities for fluidized bed research at the Canadian Combustion Research Laboratory have been improved by the development of a pilot-scale combustor suitable for testing a wide variety of solid fuels. The major features of the new facility are a 380 mm by 400 mm AFBC with variable in-bed cooling, capability of feeding a variety of fuel sizes both in-bed and over-bed, sulphur sorbent injection, and fines recycle. The combustor and its auxiliary equipment are described, and CCRL's current capabilities for AFBC research are outlined.

45398 **(PB—84-184373) Prevention of spontaneous combustion in coal in stockpiles in South Africa.** Coetzee, S.D. (Fuel Research Inst. of South Africa, Pretoria). 1983. 36p. NTIS, PC E04/MF E01.

The control of the ever present danger of spontaneous combustion in a stockpile requires a knowledge of the incipient combustion criteria, latent and mainly restricted to the chemical and physical properties of the coal surface and to the macro and micro pores in the coal substance.

45399 **Fluidized-bed combustion.** Podolski, W.F. (Argonne National Laboratory, Argonne, IL). pp 263-305 of The science and technology of coal and coal utilization. Cooper, B.R. New York, NY, USA; Plenum Press (1984).

This chapter focuses on conventional dense fluidized-bed coal combustion technology and describes the design and performance features of atmospheric and pressurized fluidized-bed combustors. Topics considered include fluidization background, fluidized-bed combustion (FBC) system description, atmospheric fluidized-bed combustors (AFBC), pressurized fluidized-bed combustors (PFBC), a comparison to conventional combustors, FBC design (mechanical design considerations, environmental considerations), and analytical system performance modeling (hydrodynamics, com-

bustion process). The mechanical design considerations are process containment, the air distributor, heat transfer, solids feed, discharge, recycle, and materials. The environmental considerations are sulfur dioxide control, NO /SUB X/ emissions, particulate emissions, combustion efficiency, and solid wastes. The main areas of concern with regard to the AFBC utility plant system are solids feeding and the distribution system, operation and control, reliability and safety, materials compatibility and corrosion/erosion, bed performance and combustion efficiency, and system simulation and the accumulation of a data base. There are special problems related to integration of a gas turbine in a PFBC system.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 01500045347, 45369, 45386

45400 (GAO/RCED—84-167) Deficiencies in the Department of the Interior OIG investigation of the Powder River Basin coal lease sale. Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 11 Jun 1984. 47p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760. File Number TI84901893.

Subsequent to the controversial Powder River Basin coal lease sale of 1982, the Office of Inspector General (OIG) of the Department of the Interior investigated and reported on issues related to the sale. GAO reviewed the reports and related investigative work and found them to be inadequate and incomplete. Numerous leads were either dismissed or not pursued to reasonable conclusions, and serious discrepancies were never resolved. In GAO's view, these issues are important and still need to be addressed in a thorough manner. GAO believes the Secretary of the Interior should use GAO's report and the results of the Department's own investigation to resolve all unanswered questions and take such further actions as may be appropriate.

45401 (PB—181177) Survey of opportunities to stimulate coal utilization. Volume 1. (Booz, Allen and Hamilton, Inc., Chicago, IL (USA)). 2 Apr 1962. 235p. NTIS, PC A11/MF A01. File Number TI84901890.

A major conclusion of the study is that specific, realistic short-run opportunities exist for substantially expanding coal utilization. Although new concepts and break-throughs are needed if the coal industry is to experience assured and continuing growth, such concepts and break-throughs, including the application of technologies in other industries, are not likely to yield major tonnage dividends in the short run - which is a basic criterion of this study. The past and on-going programs of the Bureau of Mines, Bituminous Coal Research, and several organizations and companies, combined with evolving fossil fuel price patterns, have made it possible for significant tonnages to be generated by the selected opportunities. In total, the recommended opportunities involve an annual expanded utilization potential estimated at between 40 million and 64 million tons by 1967. By 1975, the potential impact is estimated to be between 143 million and 198 million tons annually. These tonnage figures stem from five primary opportunities: coal-fired boiler; transportation systems (coal pipeline, the integral train, and extra high voltage transmission); electric space heating; producer gas; and coal injection systems for blast furnaces. Four other significant or special opportunities more likely to be realized after 1967, are: coal-fired gas turbine; water gas; integrated plants (involving the production of solids, synthetic liquid, and gaseous materials); and coal as a melting agent. For each of these opportunities, practical progams are proposed for the achievement of the potential tonnages. Implementation of the recommended program is urgent. In summary, we believe that these carefully selected opportunities and the recommended programs represent a practical, attainable, balanced program for the coal industry. If this program is implemented promptly and assiduously, significant tonnages would result. The coal industry and the nation would benefit.

45402 (PB—181178) Survey of opportunities to stimulate coal utilization. Volume II. (Booz, Allen and Hamilton, Inc., Chicago, IL (USA)). 2 Apr 1962. 165p. NTIS, PC A08/MF A01. File Number TI84901891.

Realistic and significant opportunities to expand coal utilization during the five years beyond 1962 are identified. The work covers coal products, processes, equipment, and applications. Facts were obtained in the US and Europe for an integrated analysis of coal properties, uses, technology, markets, competition, and economics. Five primary opportunities were selected and action programs were developed. Four special opportunities were identified for longer term realization. Approximately 500 items were included in inventory opportunities. 93 references. (PSB)

0160 Health And Safety

REFER ALSO TO CITATION(S) 01600045374, 45383, 46644, 46733, 46748

45403 (DOE/MC/08712—T1) Effects of coal combustion and gasification process contaminants on pulmonary defense mechanisms. 3rd quarter and final progress report. Lee, P. (West Virginia Univ., Morgantown (USA)). 13 Jul 1979. Contract AT21-77MC08712. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017597.

This project has involved the study of the effects of effluents from coal combustion processes on alveolar macrophage function using the rat and rabbit as the experimental animals. A number of alveolar macrophage functions are inhibited by several heavy metals (Cd, Ni, Pb) which are contained in the respirable particulates of coal combustion flyash. Lysosomal enzyme activities and lysosomal enzyme latency are inhibited but only at high metal concentrations. The same was found for phagocytosis. The oxidative responses to zymosan challenge were much more sensitive to the effects of metals with chemiluminescence being the most sensitive. 7 figures, 7 tables.

02 PETROLEUM

0201 Reserves

45404 (DOE/EIA—0452) Two approaches to the linkage of US oil and gas reserves estimates. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas Statistics). Jul 1984. 358p. NTIS, PC A16/MF A01; 1 - GPO; GPO Dep. File Number DE84017444.

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The statistics on proved reserves are important inputs to many energy supply monitoring and modeling activities. Significant differences are sometimes seen between the volumetric estimates produced by each program. These differences arise from two principal sources: (1) the markedly different methodologies employed, and (2) the inherent and unavoidable range of reasonableness which surrounds all estimates of proved reserves. Differences among proved reserve estimates, even when estimators have access to the same data, occur because proved reserves are estimated quantities not subject to direct measurement. The purpose of this report is to present two examples of how one might deal with the data discontinuity issue. The first method illustrates an approach based upon an arbitrary or arithmetic transition from the API/AGA data series to that of EIA. The work on the arithmetic approach was done by the EIA staff. The second method provides an example of how a data transition might be made based upon a detailed but subjective and retrospective analysis of how well each published series corresponded to reported oil and gas developmental activity. This work was done by Dr. Richard Nehring of the Rand Corporation under contract to the EIA. Both examples address the problem at the most disaggregate levels possible, later summing their results to state and national totals. Each method also provides complete adjustment details across all reserve-change elements and thus specifies a linkage from one data series to the other. The methodologies presented here are representative of only two of a multitude of possible solutions. Many different linkage options exist. The Energy Information Administration leaves the acceptance, rejection, or modification of these examples to the discretion of the individual user. The Energy Information Administration makes no claim as to the validity of either methodology illustrated. 7 references, 12 figures, 95 tables.

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 02020045418, 45423, 45463, 45874, 46757, 46768, 46772, 46782

45405 (CONF-8203181—Summs.) **Thirteenth annual Appalachian petroleum geology symposium on Appalachian reservoirs and targets: program and abstracts.** (West Virginia Geological and Economic Survey, Morgantown (USA); West Virginia Univ., Morgantown (USA). Dept. of Geology and Geography). 1982. 98p. NTIS, PC A05/MF A01. File Number DE84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

A total of 30 abstracts and papers which were presented at the Appalachian petroleum geology symposium are presented. All abstracts and papers have been processed for inclusion in the Energy Data Base. Topics covered stratigraphy, petrology, diagenesis, and well drilling statistics of the Appalachian basin.

45406 (CONF-8203181—Summs., pp 3) **Pennsylvania reservoirs: a core workshop.** Abel, K.D.; Laughrey, C.D. (Pennsylvania Geological Survey, Pittsburgh). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

45407 (CONF-8203181—Summs., pp 4-9) **1981 Drilling activity in West Virginia.** Avary, K.L. (West Virginia Geological and Economic Survey, Morgantown). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

45408 (CONF-8203181—Summs., pp 12-13) **Structural and stratigraphic plays in the Trenton Limestone, northwestern Ohio.** Coogan, A.H. (Kent State Univ., OH). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

The Trenton Limestone (Ordovician) is the main reservoir in the Lima-Indiana Field of northwestern Ohio, eastern Indiana, and in a series of 32 other Trenton fields which lie northwest and southeast of the main trend on the flanks of the Michigan and Appalachian basins, respectively. The Lima-Indiana Field was discovered near Findlay, Ohio, in 1884 by drilling in the vicinity of gas shows noticed in water wells in the overlying Silurian strata. There are at least 61 named Ohio fields in the trend and adjacent to it; of these, 80% were discovered before 1902. After 1902, at least 12 other fields were discovered and minor exploration activity continues today for Trenton production in northwestern Ohio. The Trenton fields have produced over 250 million barrels of oil from depths as shallow as 1100 feet. Gas production ranges from noncommercial to wells which produced over 25 MMCF/D initially. No cumulative gas production figures are known. The Trenton Limestone reservoir is mainly in the upper dolomitized part, but minor production is obtained from within the Trenton and from the underlying Black River Limestone. Traditionally, the dolomitization has been attributed to an unconformity at the top of the Trenton, but penecontemporaneous dolomitization and secondary dolomitization along fractures or faults appears equally likely. The Trenton Limestone is overlain by the Utica Shale or the Cynthiana Formation (calcareous shales and shaly limestones). The Utica is the seal for the reservoir and possibly the source of the oil. No studies are known which address the hydrocarbon source or the degree of maturation of the source beds and petroleum. Relatively recent work has involved new stratigraphic correlations. The resultant new isopach and structural maps and cross sections show that structural and combined structural and stratigraphic configurations (plays) help explain most of the petroleum occurrences in the Lima-Indiana trend and the outlying Trenton fields.

45409 (CONF-8203181—Summs., pp 29) **Carbonate buildups and cementation, Middle Ordovician, Virginia.** Grover, G. Jr.; Read, J.F. (Gulf Oil Exploration Co., Midland, TX; Virginia Polytechnic Inst. and State Univ., Blacksburg). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

45410 (CONF-8203181—Summs., pp 30) **Oil and gas developments in Pennsylvania in 1981.** Harper, J.A. (Pennsylvania Geological Survey, Pittsburgh). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

45411 (CONF-8203181—Summs., pp 36) **Tuscarora stratigraphic framework and regional relationships.** Knight, W.V. (Knight Exploration Co., Tulsa, OK). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

45412 (CONF-8203181—Summs., pp 39) **Clinton sand reservoirs of Ohio.** Overbey, W.K. Jr. (Petroleum Development Corp., Bridgeport, WV). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

45413 (CONF-8203181—Summs., pp 54-57) **Fractured reservoirs and targets of the Appalachian basin and thrust belt.** Tillman, N. (Gruy Co., Arlington, VA). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

Naturally occurring fracture systems are necessary in many parts of the Appalachians for a reservoir to be productive. They are critical for production in Devonian shale and tight sand formations even when artificially stimulated because the success of hydraulic fracturing is dependent on intersecting natural fractures. Fractures become increasingly important to the east because of decreasing matrix porosity and permeability resulting from increased recrystallization and cementation during both diagenesis and epigenesis. Production from the fold and thrust belts is therefore dependent on the formation of fractured envelopes associated with macroscopic structures. Although the significance of these natural fracture systems relative to production is widely recognized, little work has been performed to decipher the details of their relationship to the migration and concentration of hydrocarbons. The most direct approach to gaining an understanding of this relationship is a thorough analysis of the geochemical record deposited on fractures and in pores during migration events. The value of this approach can be greatly enhanced if integrated with a petrofabric analysis of the structural and textural setting of the paragenetic sequence. This method has been used to differentiate overlapping fracture systems and multiple migration events. It can prove very useful in delineating migration paths and targeting fractured reservoirs. 3 figures.

45414 **(DOE/MC/20037—1644) Arctic ice island and sea ice movements and mechanical properties. Second quarterly report, 1 January-31 March 1984.** Sackinger, W.M.; Stringer, W.J.; Serson, H. (Alaska Univ., Fairbanks (USA). Geophysical Inst.). 1984. Contract AC21-83MC20037. 189p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE84016323.

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Research activities for the second quarter are presented for the following tasks: (1) ice island; (2) Chukchi Sea pack ice age; and (3) mechanical properties of sea spray ice bonds structures. The research program on ice islands has four objectives: (1) establish a time history of all of the Arctic ice shelves and an historically-verified source function for ice islands through the use of aerial photography, satellite imagery, and all available historical records; (2)

establish positioning buoys on the existing ice islands to track their trajectories daily and to telemeter daily barometric pressure and temperature, via System Argos; (3) relate geostrophic winds to the observed trajectories; (4) build a pseudo-random model for ice island motion over the long term which will enable a determination of the probability of interaction ice islands and offshore structures. Task 2 is designed to determine probabilities of ice-free summer periods, their duration and extent, for the US portion of the Chukchi Sea. The emphasis on Task 3 is to measure the bond strength between the spray ice and various coatings which might be used on offshore structures. Significant progress was made on all three tasks and detailed reports are presented. 54 figures.

45415 **(N—8423959) The Arctic platform in the national petroleum reserve in Alaska: Deposition, deformation and petroleum potential.** Kirschner, C.E. (Geological Survey, Washington, DC (USA)). 1983. 4p. NTIS, PC A04/MF A01.

The National Petroleum Reserve in Alaska (NPRA) covers an area of 93,240 square km or about half of the Arctic slope in the west-central part of northern Alaska. The major elements of the geology and a few aspects of the stratigrahic history and structural development of the Arctic platform that have a significant bearing on the oil and gas potential of the region are outlined. The Arctic platform was originally defined as a pre-Albian tectonic feature that occupied the northern part of the present coastal plain and the adjacent area of the Arctic Ocean. The area of the platform is viewed as extending southward in the subsurface across the NPRA at least to the north front of the Brooks Range.

45416 **(NP—4901765) Fracture framework: a controlling factor in the accumulation of hydrocarbons in southwestern Ontario.** Sanford, B.V.; McFall, G.H. (Geological Survey of Canada, Ottawa, Ontario). 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84901765.

Figures and maps are presented for the following: basin utilization, southwestern Ontario; isopach and facies of Guelph carbonate, Huron area; isopach of B unit Salina salt, Huron area; structure contours on Rochester Formation, southwestern Ontario; conceptual fracture framework, southwestern Ontario; Upper Cambrian paleogeology, southwestern Ontario; Upper Cambrian (block rotation) play, example - Clearville area; Middle Ordovician carbonates, southwestern Ontario; Middle Ordovician (permeability pinchout) play, example - Dover area; Middle Silurian (Guelph) facies and reef trends, southwestern Ontario; Middle Silurian (patch and pinnacle reef) play, example - Wallaceburg area; Upper Salina evaporites, southwestern Ontario; and isopach of Bass Islands carbonate, Kent County.

45417 **(NP—4901770) Oil and natural gas resources of Canada, 1983.** Procter, R.M.; Taylor, G.C.; Wade, J.A. (Geological Survey of Canada, Ottawa, Ontario). 1984. 65p. Canadian Government Publishing Centre, Supply and Services Canada, Hill, Quebec K1A 0S9. File Number TI84901770.

The oil and natural gas resources of Canada are evaluated on a systematic basis by the Geological Survey of Canada. This report summarizes the current estimates of quantities of oil and natural gas that are inferred to exist but not yet discovered. The analysis of resources is made for each of Canada's six petroleum regions, addressing both conventional and non-conventional resources. The present report, which replaces Oil and Natural Gas Resources of Canada - 1976 published by Energy, Mines and Resources in 1977, contains major revisions and new estimates for most parts of Canada. The estimates of potential resources, those inferred to exist but as yet undiscovered, prepared by the Geological Survey of Canada are supplemented by estimates of reserves, or discovered resources, provided by the Canada Oil and Gas Lands Administration for frontier areas; and by the National Energy Board for the Western Canada Sedimentary Basin. 37 references, 74 figures, 13 tables.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 02030045405, 45408, 45412, 45463, 46790

45418 (CONF-8203181—Summs., pp 21-23) **Virginia oil and gas production, exploration, and development summary, 1981.** Fulmer, B.T. (Virginia Division of Mines and Quarries, Big Stone Gap). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

45419 (CONF-8203181—Summs., pp 24-28) **Current drilling activity in Ohio.** Gray, J. (Ohio Geological Survey, Columbus). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

A total of 5172 well completions were reported in 1981, establishing a modern-day drilling record for the state. There was an increase of 1727 completions or 50% more than the 1980 totals. It is anticipated that the current drilling boom in Ohio will start leveling off during 1982. Permitting activity for January and February, 1982, is still moving at a brisk pace, but there has not been a significant increase over the 1981 rate of issues. Also, the number of rotary rigs operating in the state has stabilized at about 90 to 100 rigs after climbing steadily for the last several years. Development of the Clinton fields will continue to dominate the drilling activity. Berea drilling will increase significantly if the Federal Energy Regulatory Commission gives the Second Berea sandstone a tight gas sand designation as anticipated.

45420 (CONF-8203181—Summs., pp 38) **Tennessee oil and gas activity, 1981.** Miller, R.A. (Tennessee Oil and Gas Board, Nashville). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

45421 (CONF-8203181—Summs., pp 40-47) **Review of eastern Kentucky drilling and development in 1981.** Ponsetto, L.R. (Univ. of Kentucky, Lexington). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

During 1981, drilling activity in Kentucky increased for the second consecutive year. The Oil and Gas Division of the Kentucky Department of Mines and Minerals reported that 5364 permits were issued in 1981 for the drilling of oil and gas wells. Compared with 4132 permits issued in 1980, this is an increase of approximately 30 percent. Although the 1981 increase is not as impressive as the increase for the previous year, it continues the trend of increased activity in Kentucky. This trend will have a definite effect on oil and gas exploration and development. Some expected results are an increase in new discoveries and subsequent increases in production and reserves. For example, an approximate 30-percent increase in total completions in 1981 resulted in an increase of 20 new discoveries, 12 pool extensions, and 242 development wells over the previous year. Available oil production data also indicate an increase over the previous year. An increased interest in tertiary recovery operations for oil has resulted in the initiation of several new projects in Kentucky. The micellar-polymer flood which commenced in 1980 in the Big Sinking Field of Lee County continues to be developed. A second micellar-polymer flood has commenced in the Ashley Pool of Powell County. A third enhanced recovery project using CO_2 has commenced in the Ivyton Pool located in Magoffin County. It is still too soon to expect any significant results. 4 figures, 2 tables.

45422 (CONF-8203181—Summs., pp 58-61) **Review of 1981 oil and gas well drilling in New York with overview of oil and gas developments during 1977 to 1980 period.** Van Tyne, A.M. 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

During 1981, 514 well completion reports for wells drilled in New York were filed with the New York State Conservation Department. General information indicates that approximately 200 additional wells were completed here during 1981, so the actual total of wells completed is estimated to be about 700. Of the filed total, 444 were reported as development wells. This includes 87 oil wells, 352 gas wells, and 5 dry holes. Six water injection service wells were completed in the oil fields during 1981. There were 64 exploratory tests completed and of this total, 52 were gas wells and 12 were dry holes. During the four years (1977 to 1980) 2308 wells were drilled. These include 614 oil producing wells, 1331 gas producers, 198 water input wells for secondary recovery of oil, and 165 dry holes. The decline in New York oil production was reversed briefly when there was a small increase from 813, 313 bbl in 1977 to 854,604 bbl by 1979. In 1980, the decline commenced again with oil production of 824,296 bbl. Production of natural gas continued a several year increase from 10,682 MMcf in 1977 to 15,680 MMcf in 1979. According to preliminary figures, production in 1980 declined slightly to 16,652 MMcf.

45423 (CONF-8203181—Summs., pp 65-74) **Oil and gas drilling statistics for West Virginia during 1981.** Avary, K.L.; Brock, S.M.; Behling, M.C.; Cardwell, D.H.; Patchen, D.G. (comps.). (West Virginia Geological and Economic Survey, Morgantown). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

Data are presented in tabular form for the following: (1) oil and gas operations in West Virginia for 1981; (2) most active fields in West Virginia in 1981; (3) completion summary for West Virginia wells, 1981; (4) important exploratory successes in West Virginia in 1981; (5) important exploratory failures in West Virginia in 1981; (6) stratigraphic summary of wells completed in West Virginia during 1981; (7) production in West Virginia in 1981; (8) summary of permits issued by formation within county, West Virginia, 1981; and (9) stratigraphic summary of successful wells completed during 1981 in West Virginia.

45424 (DOE/BC/10310—34) **Measurement and correlation of conditions for entrapment and mobilization of residual oil. Final report, January 1981-March 1984.** Morrow, N.R. (New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center). Oct 1984. Contract AS19-80BC10310. 192p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE84017404.

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This is the final report of a two-year project which had four major task areas. A substantial portion of work carried out under this project has been reported in detail in journals, the First Annual Report to the Department of Energy or in manuscripts which have been submitted for publication and are available on request. In such cases only major conclusions are reported, along with reference to the detailed accounts. Work is reported for the following 4 major tasks: (1) residual saturation measured by laboratory core flooding (core flooding experiments, contact angle measurements); (2) effect of high pressure gradients on residual oil saturations (capillary number relationships, residual oil flushing at wellbore, electrical resistivities at reduced residual oil saturations); (3) mechanisms of mobilization and entrapment of residual oil (magnitude and detailed structure of residual oil saturations, effect of interfacial tension on the stability of displacement fronts, effect of pore shape on displacement curvatures); and (4) residual oil structure (analysis of blob-size distributions by Coulter counter, changes in residual oil structure with oil recovery). 53 references, 76 figures, 46 tables.

45425 (DOE/BC/10704—8) **Detailed technical and economic feasibility of light oil mining in the United States. Final report.** Albayrak, F.A.; Protopapas, T.E. (Fuel and Mineral Resources, Inc., Reston, VA (USA)). Aug 1984. Contract AC19-82BC10704. 483p. NTIS, PC A21/MF A01; GPO Dep. File Number DE84015848.

The initial Scope of Work of the present report called for a study to provide a detailed Technical and Economic Feasibility Analysis of three oil mining methods as applied to three oil reservoirs. The three pre-selected methods were: (1) spoke drilling from bottom of shafts; (2) spoke drilling from bottom of shafts, of lesser density of drill holes and stimulation of the formation through explosive fracturing of the horizontal holes; and (3) block caving mining method. At the request of DOE, the second option was replaced with the Lateral Horizontal Drilling from Ribs of Tunnels concept. A specific application of the explosive fracturing of the horizontal boreholes concept was not attempted here, but a description of the technique is provided for future consideration. Each of the three mining methods were to be applied to each of the three reservoir formations to be exploited by oil mining. Thus, nine oil mining case studies were to be performed, including both technical and economic feasibility elements. However, it was later decided to apply selective oil mining methods to each of the three reservoirs. All key unit operations of each mining method were to be identified and the mining and construction requirements associated with each unit operation were to be quantitatively specified. Key unit operations were to include among others; shaft excavation, shaft lining, shaft grouting, tunnel excavation, tunnel lining, oil collection chamber excavation, well bore stimulation (such as explosive fracturing, MHF, etc.) positive displacement of oil pumping from underground mine workings to the surface. Results of the study are presented. 70 references, 132 figures, 119 tables.

45426 (DOE/BP—84/1) **Contracts for field projects and supporting research on enhanced oil recovery and improved drilling technology. Progress review No. 37, quarter ending December 31, 1983.** Linville, B. (ed.). (USDOE Assistant Secretary for Fossil Energy, Washington, DC. Office of Oil, Gas and Shale; USDOE Bartlesville Project Office, OK (USA)). Aug 1984. 92p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84012763.

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Project reports are presented for field projects and supporting research for the following: chemical flooding; carbon dioxide injection; thermal methods; resource assessment technology; extraction technology; environmental and safety; microbial enhanced oil recovery; and general supporting research.

45427 (DOE/FE—0043) **Investigation on the continued production of the Naval Petroleum Reserves beyond April 5, 1985.** (USDOE Assistant Secretary for Fossil Energy, Washington, DC. Office of Naval Petroleum and Oil Shale Reserves). Aug 1984. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017402.

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This report describes the scope, findings and conclusions of an investigation which has been conducted by the Department of Energy to determine whether it is in the national interest to continue production of the Naval Petroleum Reserves (NPR) for another three years beyond April 5, 1985. The investigation considered the impacts on the national interest in terms of national defense capabilities, the national economy, local and regional economies, and national energy objectives. The conclusion is that continued production of NPR-3, until April 1988, is in the national interest for the following reasons: (1) The remaining reserves and potential production rates at NPR-3 are so small that there would be virtually no national defense value or other national benefit in conserving NPR-3 for future use. NPR-3 production will be only about 3200 barrels per day in 1985, and total remaining recoverable reserves at NPR-3 will be less than 13 million barrels, using conventional recovery methods. (2) Extensive enhanced oil recovery (EOR) techniques have been initiated at NPR-3 to increase significantly the ultimate total recovery from this Reserve where it is estimated that only slightly over 5% of the oil in place can be recovered using primary and secondary recovery techniques. Shutting in the Reserve would effectively negate the EOR efforts already expended at the site. Continued production will permit continuation of the long-term EOR efforts, which could increase ultimate recovery by 30 to 80 million barrels. 9 tables.

45428 **(DOE/SF/01424—51) Big Muddy Field Low-Tension Flood Demonstration Project. Sixth annual report, April 1983-March 1984.** (Conoco, Inc., Casper, WY (USA)). Oct 1984. Contract AC03-78SF01424. 108p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84017405.

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The Big Muddy low-tension flood is a commercial-size demonstration project consisting of nine 10-acre injection patterns in the heart of the Big Muddy Oil Field located 15 miles east of Casper, Wyoming. The main goal of the project is to provide data for commercialization of the process for the Big Muddy Field and similar Wyoming and Colorado fields. Other objectives are discussed in previous annual reports. This report discusses the project performance during the polymer drive phase with emphasis on the analyses of oil cut, pattern balance, and early tracer response. The oil rate increased only slightly during 1983 and began to flatten near year-end at about 210 barrels per day or 12% of the injection rate. The injection rate was increased in late 1982 and early 1983 but simply resulted in a net input (influx plus injection) greater than production with only slight improvement in oil rate. In fact, the imbalance is suspected of contributing to the early flattening in oil production. Though the project oil rate flattened, an increased cut was observed in the north row of wells, indicating an oil response to slug injection in all wells except Well 54. Also during 1983, the polymer drive volume increased to about 10% of pore volume or to the midpoint of the polymer drive. Tracer and slug components have still appeared in only a few wells, even after 20% pore volume injection. Oil treating was becoming more troublesome but was relieved when the new treating facility was put into use. 5 references, 91 figures, 7 tables.

45429 **(NIPER—12) State-of-the-art of microbial enhanced oil recovery: a review of the literature.** Smith, R.J.; Collins, A.G. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Oct 1984. Contract FC01-83FE60149. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017403.

This report is an overview of the literature on enhanced oil recovery (EOR) using microorganisms. Microorganisms can contribute to four major areas of oil technology, three of which relate to EOR: (1) microorganisms, because of their ability to grow rapidly and excrete several types of by-products, are used to manufacture biosurfactants and biopolymers for EOR; (2) microorganisms can be injected in situ to recover residual oil; (3) microorganisms can be used to selectively plug high permeability channels in reservoirs; and (4) microorganisms can be used to remove sulfur or nitrogen from crude oils, to reduce the viscosity of crude oils, and to clean up oil spills. Before either chemical or microbial technology is established, their environmental impacts should be defined. Environmental concerns of microbial EOR (MEOR) technology are presented in this report. The adverse effects of bacteria indigenous to some reservoirs, e.g., the sulfate reducers and certain aerobic bacteria, also are discussed with respect to MEOR processes. 64 references.

45430 **A laboratory study of CO_2 foam properties and displacement mechanism.** Wang, G.C. (Univ. of Alabama). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 12645**: 169-176(Apr 1984). (CONF-8304162—).

From 4. SPE/DOE symposium on enhanced oil recovery; Tulsa, OK, USA (16 Apr 1983).

This paper presents the results of a comprehensive study of CO_2-foam physical properties and a series of displacement tests using a high pressure glasslined flow-tube. The foam properties were studied in terms of foam quality, quantity and stability as functions of temperature, pressure surfactant concentration and surfactant mixing ratio. The CO -foam displacement tests were performed using SACROC and Rock Creek crude oils, and the oil recovery efficiency was visually investigated for both secondary and tertiary modes with varying CO_2 slug injection sequence and surfactant concentration. The results indicate that the increase of pressure promotes foam stability whereas the increase of temperature does the contrary. It was found that CO_2-foam generated either externally or internally is susceptible to quick distintegration on contact with crude oil. Therefore, the control of CO_2 mobility using a foaming agent could be effective only within a short distance from the injection well. Any improvement on oil recovery or gasoil ratio is probably obtained as a result of foam blockage of the permeable streaks or channels in the injection formation. It was found that excessively high concentrations of surfactant (foaming agent) may cause "foam barrier" to decrease sweep efficiency.

45431 **The phase behavior of systems comprising North Sea reservoir fluids and injection gases.** Varotsis, N.; Clancy, M.; Stewart, G.; Todd, A.C. (Heriot-Watt Univ.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 12647**: 177-192(Apr 1984). (CONF-8304162—).

From 4. SPE/DOE symposium on enhanced oil recovery; Tulsa, OK, USA (16 Apr 1983).

The design and use of an experimental system to measure the phase behaviour of systems comprising of reservoir fluids and injection gases is described in the first part of this study. The experiments can simulate in the laboratory the mass transfer that takes place between the advancing injection gas phase and the oil phase in the reservoir. A special feature of the equipment is the direct transfer of microlitre samples of the equilibrium high pressure phases to the gas chromatograph, thus eliminating errors associated with conventional blow down techniques. In the second part of this work, the developed phase behaviour simulator is described briefly and its main features are discussed. The use of the Schmidt-Wenzel Equation of State has improved drastically the accuracy of the predicted liquid phase densities at reservoir temperature and the COSTALD correlations are recommended for STO volumes. Generalised correlations for the interaction parameters of CO_2-hydrocarbons and CH_4-hydrocarbons have been developed from binary experimental data. Temperature and pressure dependent coefficients were found to match with excellent accuracy multicomponent mixtures' saturation data. The phase behaviour simulator tuned on own experimental data was used to predict miscibility conditions for a North Sea STO and a North Sea reservoir oil for CO_2 and N_2 injection schemes.

45432 **Correlation of minimum miscibility pressure for impure CO_2 streams.** Sebastian, H.M.; Renner, T.A.; Wenger, R.S. (Amoco Production Co.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 12648**: 193-200(Apr 1984). (CONF-8304162—).

From 4. SPE/DOE symposium on enhanced oil recovery; Tulsa, OK, USA (16 Apr 1983).

The displacement efficiency of oil by carbon dioxide is highly pressure dependent and miscible displacement efficiency is only achieved at pressures greater than a certain minimum. This minimum miscibility pressure (MMP) is a function of temperature and composition of the injection gas. The study presented in this paper examines the effect on MMP of up to 55 mole percent impurities in the CO_2-rich injection gas. A correlation of these data was developed based on the mole average pseudocritical temperature (TCM) of the gas and the minimum miscibility pressure of pure CO_2 with the same oil at the same conditions. In general, it was found that increasing the TCM of the gas lowered the MMP and decreasing the TCM increased the MMP. Injection gases with the same TCM but very different compositions were found to have the same MMP. Various correlating parameters were tried but TCM was found to be the most suitable. This correlation is compared to others in the literature and found to be superior in the case where the drive gas contained both light and intermediate components. The correlation indicates that miscibility in a field-wide CO_2 flood may be maintained by reinjection of impure CO_2 streams if sufficient intermediate hydrocarbons are present in the produced gas to offset the effects of lighter gases. Since CO_2 cleanup is one of the major costs in fieldwide CO_2 flooding, reduction or complete elimination of produced gas cleanup will have a significant positive impact on process economics. The operational and regulatory aspects of injecting an impure CO_2 stream must be considered, however, in order to optimize the recycling scheme.

45433 **Effect of varying polyacrylamide molecular weight on tertiary oil recovery from porous media of varying permeability.** Ball, J.T.; Pitts, M.J. (Surtex Inc.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 12650**: 201-208(Apr 1984). (CONF-8304162—).

From 4. SPE/DOE symposium on enhanced oil recovery; Tulsa, OK, USA (16 Apr 1983).

Three different molecular weight emulsion polyacrylamides (PAA) have been tested for their ability to recover oil from a multi-permeability Berea core system. Injection of a 6.5 x 10^6, 17 x 10^6, and 36 x 10^6 molecular weight PAA resulted in oil recovery from the multiple permeability core systems of 53.4, 63.7, and 57.2 percent of the waterflood residual oil, respectively. In tests with 15 g/kg Na_2CO_3, injection of the polymer systems resulted in recoveries of 65.6, 75.3, and 68.0 percent of the waterflood residual oil, respectively. In the presence of alkali, the injection of high molecular weight PAA resulted in the reduction of fluid flow into the medium and low permeability cores with 70 to 75 percent of the tertiary oil being recovered from the high permeability core. Decreasing the PAA molecular weight to 17 x 10^6 and subsequently to 6.5 x 10^6 resulted in an increasing amount of fluid flowing through the low and medium permeability cores. While decreasing the molecular weight of the PAA resulted in increased fluid diversion, the 6.5 x 10^6 molecular weight PAA recovery efficiency was less than either of the other two polymers in the high permeability core. The data indicates selection of too large a polymer can result in less than maximum oil recovery from a heterogeneous permeability reservoir as a result of lower sweep efficiency. Selection of too small a polymer can result in less than maximum oil recovery from a heterogeneous permeability reservoir as a result of decreased oil recovery from the high permeability zones. Proper selection of polyacrylamide for a heterogeneous permeability reservoir either in the presence or in the absence of alkali will maximize oil recovery.

45434 **Mechanical degradation of polyacrylamide solutions in core plugs from several carbonate reservoirs.** Martin, F.D. (New Mexico Inst. of Mining and Technology). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 12651**: 209-222(Apr 1984). (CONF-8304162—).

From 4. SPE/DOE symposium on enhanced oil recovery; Tulsa, OK, USA (16 Apr 1983).

This paper presents results of laboratory studies on mechanical degradation of partially hydrolyzed polyacrylamide (HPAM) solutions in core samples from several different carbonate reservoirs. Studies in carbonates are of particular importance because several of the larger polymer projects are in carbonate reservoirs and because data on carbonate rocks have not previously been available. Much of the data in the literature was obtained with solutions of polymer in brine. Since HPAM polymers are generally more efficient in fresh waters, lower salinity waters were used for the bulk of the present study. Variables investigated included: polymer molecular weight, polymer concentration, and salinity of the aqueous solvent. The HPAM samples used were commercial products of varying molecular weight. Results were compared to correlations previously developed for sandstone core plugs and uncosolidated sands.

45435 **Quantification of viscoelastic effects of polyacrylamide solutions.** Heemskerk, J.; Holtslag, R.J.; Janssen-van Rosmalen, R.; Teeuw, D. (Koninklijke/Shell E & P Laboratorium). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 12652**: 223-230(Apr 1984). (CONF-8304162—).

From 4. SPE/DOE symposium on enhanced oil recovery; Tulsa, OK, USA (16 Apr 1983).

Beyond a critical rate of flow in cores the viscoelasticity of polyacrylamide solutions is reflected by shear thickening behaviour. Practical information is provided on the critical flow rate and magnitude of shear thickening and their dependency on core permeability, temperature, molecular weight and concentration of commercial polymers. To describe the onset of shear thickening, critical Deborah numbers were calculated using fluid relaxation times obtained by oscillation rheometry. Using three core-flow parameters, viz. the critical flow rate and two powerlaw exponents, the viscoelastic effects are quantified.

45436 **Development of a new aluminum-polymer gel system for permeability adjustment.** Dovan, H.T.; Hutching, R.D. (Union Oil Co. of California). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 12641**: 129-136(Apr 1984). (CONF-8304162—).

From 4. SPE/DOE symposium on enhanced oil recovery; Tulsa, OK, USA (16 Apr 1983).

A new method for gelling polymer with aluminum has been developed to reduce reservoir heterogeneity resulting in improved waterflood efficiency and higher oil recovery. The method uses a soluble aluminum compound in a high pH, nonreactive form that is mixed directly with the polymer at optimum concentrations. Polymer gelling occurs in the reservoir when reactive aluminum is generated by consumption of hydroxyl ions. Variations in gel strength and gel time are made by adjusting polymer and aluminate concentrations in the slug to the desired levels. This process has several advantages over the currently practiced aluminum citrate technology as well as the chromium redox bulk gel system. Although the process works best in fresh water systems, it can be modified to accommodate waters with higher brine content. Laboratory development of the process and a successful field trail are described in the paper.

45437 **Kinetics of polymer/metal-ion gelation.** Prud'homme, R.K.; Uhl, J.T. (Princeton Univ.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 12640**: 121-128(Apr 1984). (CONF-8304162—).

From 4. SPE/DOE symposium on enhanced oil recovery; Tulsa, OK, USA (16 Apr 1983).

Polyacrylamide and partially hydrolyzed polyacrylamide solutions can be crosslinked by tri-valent chromium ions to form stable gels. In this study the kinetics of the gelation reaction are determined from the time dependence of dynamic mechanical measurements using classical network elasticity theory to relate the storage modulus of the gel to the number density of crosslinks. The reaction is second order in chromium ion concentration corroborating previous reports of a bi-molecular chromium ion complex. Gelation studies with anionic and nonionic polyacrylamides in NaCl, KI, and Na_2SO_4 solutions show that electrostatic interactions between chain segments alter the rate of reaction. The effects are successfully modeled using electrostatic theories of Odijk and Fixman.

45438 **Viscometric measurement of chromium(III)-polyacrylamide gels by Weissenberg rheogoniometer.** Aslam, S.; Vossoughi, S.; Willhite, G.P. (Univ. of Colorado-Colorado Springs). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 12639**: 113-120(Apr 1984). (CONF-8304162—).

From 4. SPE/DOE symposium on enhanced oil recovery; Tulsa, OK, USA (16 Apr 1983).

Gelled polymers are being used increasingly to modify the movement of injected fluids in secondary and enhanced oil recovery processes. A common gelation process involves the reduction of Cr(VI) to Cr(III) in the presence of polyacrylamide. The Cr(III) reacts or interacts with the polymer to form a gel network. Although correlations of gelation time with principal process variables have been obtained, viscometric data have not been reported during or after gelation. These data are needed for fluid flow calculations in surface equipment and estimation of flow behavior in reservoir rocks. A Weissenberg Rheogoniometer, with cone and plate geometry, was used to obtain viscometric data for the gelation of polyacrylamide and chromium (III). Solutions consisting of polyacrylamide polymer, sodium dichromate-dihydrate and sodium bisulfite were gelled under a steady shear field at constant temperature. The shear stress vs. time profile for the gelation process was interpreted to define a gelation time and to determine the apparent viscosity of the gelled fluid. The gelation time decreased as the applied shear rate increased up to about 14.25 sec^{-1} and was affected by shear rate history. Viscometric properties of the gelled solutions were determined. Apparent viscosity of the gelled solutions de-

creased as the shear rate under which they were formed increased. Post gelation studies indicated that gels exhibited a residual or yield stress at zero shear rate and behaved as Bingham plastics under steady shear. Gels formed at low shear rates were more viscous than gels formed at high shear rates. However, the structure of these gels was susceptible to shear degradation.

45439 **An experimental study of the in-situ gelation of chromium(+3)-polyacrylamide polymer in porous media.** Huang, C.G.; Green, D.W.; Wilhite, G.P. (CTCI/CPDC Catalyst Research Center). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE12638**: 103-112(Apr 1984). (CONF-8304162—).

From 4. SPE/DOE symposium on enhanced oil recovery; Tulsa, OK, USA (16 Apr 1983).

Gelled polymers are being used increasingly as reservoir flow control agents to improve the water-to-oil ratio in waterflooding. To date, little has been published in the open literature on the insitu gelation of polymers in porous media. This work was undertaken to study the process of in-situ gelation of a gel system consisting of a polyacrylamide polymer, sodium dichromate and thiourea. The experiments consisted of continously injecting gel solutions into one-foot unconsolidated sandpacks. Pressure distributions along the flow direction were used to interpret the nature of gelation in the porous media. It was found that gelation in porous media occured much earlier than anticipated from beaker tests where gel solutions were under conditions of no shear. For example, a gel solution with a nominal 10-day gel time in a beaker gelled in 85 hours in a porous medium run. Shear was thought to be one of the major factors affecting the in-situ gelation rate and it was determined that gelation times decreased with increasing insitu shear rates. Under the same in-situ shear rate, the in-situ gelation times were approximately equal in sandpacks prepared from different grain sizes. The order in which in-situ gelation occurred along the flow direction indicated that the shear history had an effect on gelation time. Effluents from displacements with gel solutions were analyzed to evaluate the change in the properties of a gel solution as it moved through the porous media. The chemical analysis indicated that the retention of polymer was marked after the in-situ gelation developed.

45440 **Simulation of compositional processes: The use of pseudocomponents in equation-of-state calculations.** Schlijper, A.G. (Koninklijke/Shell E & P Laboratorium). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 12633**: 49-58(Apr 1984). (CONF-8304162—).

From 4. SPE/DOE symposium on enhanced oil recovery; Tulsa, OK, USA (16 Apr 1983).

For compositional numerical reservoir simulators using an equation of state, a description of the system of reservoir fluids in terms of a limited number of pseudocomponents is required, since computing time and storage requirements for a simulation increase sharply with the number of components involved. A new method is presented for reducing a multicomponent description of a reservoir fluid system to a lumped description in terms of a few pseudocomponents. The method takes into account that a pseudocomponent, representing a mixture of pure components, has the thermodynamic behaviour of a mixture rather than that of a pure component. The equation of state is transformed into a "pseudorised" equation of state, which is then used for all phasebehaviour calculations involving pseudo-components. In addition to providing a pseudorised version of the equation of state with corresponding "pseudochemical potentials", procedures are presented for obtaining phase densities and viscosities. The utility of the method is demonstrated by comparing phase splits, lumped mole fractions in vapour and liquid phases, phase densities and phase viscosities obtained using a lumped fluid description with the same data as obtained from a fully compositional description, for three hydrocarbon systems. Generally, deviations are not more than a few percent, in many instances they are less than one percent.

45441 **An analytical model for water/gas miscible displacements.** Jenkins, M.K. (Exxon Production Research Co.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 12632**: 37-48(Apr 1984). (CONF-8304162—).

From 4. SPE/DOE symposium on enhanced oil recovery; Tulsa, OK, USA (16 Apr 1983).

This paper describes the solution to a steady-state analytical model for gravitational segregation in a water-alternating-gas (WAG) miscible displacement. The model, introduced by Stone, provides a conceptual framework for understanding the segregation process. The analysis is extended in this paper to obtain a closed-form solution to the equations, which allows one to easily estimate the incremental recovery above waterflooding for homogeneous reservoirs. This solution is useful in the design of high-recovery WAG floods. Results from the model indicate that recovery increases with dimensionless viscous-gravity ratio (VGR), which is a measure of the volume in the reservoir required to obtain complete segregation of water and gas injected into a well. The model may be used to show how changes in fluid and operating conditions affect recovery. Recovery may be increased either by increasing injection rate or solvent viscosity, or by reducing pattern area or water-solvent density difference.

45442 **Stability analysis of miscible displacement processes.** Lee, S.T.; Culham, W.E.; Gary, K.M. (Gulf R. and D. Co.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 12631**: 17-36(Apr 1984). (CONF-8304162—).

From 4. SPE/DOE symposium on enhanced oil recovery; Tulsa, OK, USA (16 Apr 1983).

This paper presents a linear perturbation analysis of viscosity- and gravity-induced instability in miscible displacement processes. The analysis takes into account the time-dependent behavior of the basic flow solution. It also considers the velocity dependence in the hydrodynamic dispersion expressions. By solving analytically the perturbation equations, the necessary and sufficient conditions for instability in miscible displacement processes are derived. These criteria are related to the well-known Dumore's velocity and to a critical wavelength for finger growth. Furthermore, they are calculated at the most unstable location in the solvent-oil mixing zone. The equations derived then relate quantitatively major process variables to the onset of instability in a miscible displacement process. Examples are presented to illustrate the applications of the criteria derived. It is shown that as the displacement process proceeds, the injection rate can be gradually increased. Furthermore, for dipping and stratified reservoirs, and for laboratory core experiments, a threshold time can be reached, after which the process is said to be in a state of unconditional stability.

45443 **Miscible flood forecasting technique at Judy Creek.** Biberdorf, O.C. (Esso Resources Canada Ltd.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 12630**: 7-16(Apr 1984). (CONF-8304162—).

From 4. SPE/DOE symposium on enhanced oil recovery; Tulsa, OK, USA (16 Apr 1983).

A simplified, yet rigorous forecasting technique was developed to predict the recovery performance of a hydrocarbon miscible flood in the Judy Creek Beaverhill Lake (BHL) 'A' pool in Alberta. This technique incorporates the physics of the hydrocarbon miscible displacement process as well as the complex geological reservoir description across the entire pool. The advantages of the technique over conventional three-dimensional reservoir simulation include cost effectiveness, speed, and flexibility of parametric evaluations. An areal reservoir simulation model was used to describe the areal sweep; oil recovery performance as a function of injection and solvent bank size; and solvent, chase gas and post-miscible water breakthrough times. The effect of gravity override was determined by a cross-sectional reservoir model. A geological model provided the porosity and permeability distribution for every 0.6 meter interval in each injection pattern as well as the continuous pore volume; i.e., the volume that is available for miscible displacement. The results of these models were combined in a simplified al-

gorithm (the Forecast Model) to predict the tertiary recovery. The Forecast Model adds the tertiary recovery forecast to the waterflood forecast, which was developed from decline analysis, to generate a total oil forecast under miscible flooding. The miscible flood forecast derived from this model is physically reasonable and predicts recovery levels consistent with observed performance of large-scale miscible projects. This technique is being extended for use in other reservoirs which are candidates for miscible flooding.

0204 Processing

45444 **(ORAU/IEA—84-10(M)) Product quality and the use of electricity in petroleum refining.** Sigmon, E.B. (Oak Ridge Associated Universities, Inc., TN (USA)). Sep 1984. Contract AC05-76OR00033. 38p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017478.

Petroleum refiners purchased 91 percent more electricity in 1982 per barrel of crude oil refined than they purchased in 1962, cutting consumption of fuels 24 percent in the same period. The growing importance of electricity as a source of refining energy results not from major process innovations but from many incremental changes. The direction of these incremental changes is set by two long-term historical trends: the increasing quality of refined products and the decreasing price of electricity relative to the price of fuels. Upgrading petroleum products to yield more light fuels, more octane, or less sulfur requires large quantities of mechanical energy for pumping and compression. Lower relative electricity costs expand the opportunities for electrically driven processes to displace fuel-driven ones. 42 references, 8 figures.

0206 Health And Safety

REFER ALSO TO CITATION(S) 02060046748

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 02070045427

45445 **(DOE/EIA—0035(84/05)) Monthly Energy Review, May 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Aug 1984. 131p. NTIS, PC A07/MF A01; 1 - GPO; GPO Dep. File Number DE84016616.

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This report presents current data on production, consumption, stocks, imports, exports, and prices of the principal energy commodities in the United States. Also included are data on international production of crude oil, consumption of petroleum products, petroleum stocks, and production of electricity from nuclear-powered facilities. Energy commodities include petroleum, natural gas, coal, nuclear, and electric power.

45446 **(DOE/EIA—0380(84/06)) Petroleum Marketing Monthly, June 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Aug 1984. 135p. NTIS, PC A07/MF A01; 1 - GPO; GPO Dep. File Number DE84017154.

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This report presents June, 1984, summaries of petroleum product statistics for the US, Petroleum Administration for Defense (PAD) districts, and individual states. Four types of petroleum product statistics are included: sale prices, sale volumes, percentages of product sales, and first sales of products for consumption. Salient statistics are highlighted in a summary section, and each of the four subjects are treated in detail in other sections. The first tables in each of the first three sections provide national-level statistics on sales of the various products to end-users and for resale. The following tables provide finer geographic and type of seller detail and are grouped by product, beginning with motor gasoline and ending with either residual fuel oil or propane. The majority of the tables show data for the report month and previous month for the current year. Data on motor gasoline, aviation fuel, jet engine fuel, kerosene, distillate fuel oils, residual fuel oils, and propane are included.

45447 **(DOE/EIA—0380(84/06)) Petroleum Marketing Monthly, June 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Aug 1984. 130p. NTIS, PC A07/MF A01 - GPO; GPO Dep. File Number DE84017220.

Statistical data about a variety of petroleum products, including motor gasoline, distillates, residuals, jet fuel, kerosene, and propane are given. The publication provides petroleum products sales statistics for use by industry, government, and private sector analysts, educational institutions, and consumers. The first tables in each of the first three sections provide national-level statistics on sales of the various products to end-users and for resale. The following tables provide finer geographic and type of seller detail and are grouped by product, beginning with motor gasoline and ending with either residual fuel oil or propane. The majority of the tables show data for the report month and previous month for the current year, and the report month for the previous year. 12 figures, 59 tables.

45448 **(DOE/EIA—0454) Model documentation: Transportation Sector Energy Demand Model.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Sep 1984. 73p. NTIS, PC A04/MF A01; 1 - GPO; GPO Dep. File Number DE84017572.

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The Transportation Sector Energy Demand (TSED) Model was developed in the fall of 1983 to function as a component of the Intermediate Future Forecasting System (EIA 1983). The model produces economically based forecasts of the demand for gasoline and diesel fuel for highway transport and jet fuel for air transport. These two modes account for over 80% of energy use by the transportation sector in the United States. Other fuels used in the transportation sector are included in TSED though in less detail. This report documents the work done to create the models and implement them. 34 references, 2 figures, 5 tables.

45449 **(NP—4770371) AFM annual report 1982.** (Aussenhandelsverband fuer Mineraloel e.V., Hamburg (Germany, F.R.)). Jul 1983. 38p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84770371.

The annual report gives comments on the situation of the mineral oil market, the market development, environmental protection, quality problems, taxes, customs, and foreign trade as well as on precautions against a crisis. The mineral oil statistics contain figures on: total supply, foreign trade, raw petroleum imports, product imports, exports, import figures, export figures, domestic sales and refinery capacities.

45450 **Oil overcharges. Hearing before the Subcommittee on Oversight and Investigations House of Representatives, Ninety-Eighth Congress, First Session, May 23, 1983.** Washington, DC; Government Printing Office (1983). 1101p.

The hearing continues the inquiry into DOE settlements with municipalities, school districts, utilities, and others who are due repayments for overcharges by the oil companies. Of particular concern to the committee was how DOE can comply with the required settlements and keep within its $7 million budget for 1984. Also of concern were the administration of audits and settlements, in particular the possibility that installment payments will reduce the settlements at the expense of the overcharged consumers. The witnesses includes representatives of DOE, the General Accounting Office, Economic Regulatory Administration, and other agencies. Material submitted for the record by DOE, the Air Transport Association of America, and the Oversight and Investigations Subcommittee and four appendices with correspondence and reports follows the testimony.

0208 Waste Management

REFER ALSO TO CITATION(S) 02080046298

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 02090045429

45451 **Evaluating a mass transfer model for the dissolution of organics from oil films into water.** Southworth, G.R.; Allen, C.P.; Herbes, S.E. (Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN). *Water Research;* **17**: No. 11, 1647-1651(1983).

A mass-transfer model analogous to one used to describe the volatilization of organics from natural waters was used to describe the dissolution of constituent organics from a floating oil film into the underlying water. The mass flux of a material across the oil-water interface was depicted using an oil-phase mass-transfer coefficient, k/SUB o/, a water-phase mass-transfer coefficient, k/SUB w/, a partition coefficient, P, describing the equilibrium partitioning of a substance between oil and water, and the concentrations of the substance in the oil and water, C/SUB o/ and C/SUB w/. Rates of dissoltion were observed to vary with properties of the solute, P, the oil (viscosity, P, oil depth) and the environment (oil and water mixing, water depth). The observed rates of dissolution of chemicals from a low-viscosity oil (heptane) varied by a factor of about 10^4 between the most rapidly and most slowly dissolving materials.

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 02100045486

45452 **(GAO/GGD—84-15) IRS' administration of the Crude Oil Windfall Profit Tax Act of 1980.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 18 Jun 1984. 139p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760. File Number TI84901897.

Anticipating that the removal of oil controls would significantly increase the oil industry's profits, the Congress enacted the Crude Oil Windfall Profit Tax Act of 1980. Under the act, oil producers pay a tax on the difference between the free market price of a barrel of oil and its controlled selling price under Department of Energy regulations. Although IRS received no supplemental funding to administer the tax, it moved quickly to establish a compliance program. So that it can further strengthen this program, GAO recommends that IRS develop a more effective means for deciding which properties containing oil wells should be subject to IRS examination; ensuring that the windfall profit tax was in fact assessed on the initial sale of oil subsequently resold many times; and examining tax refund claims based on the very complex section of the law which is designed to assure that the tax is levied only on barrels of oils which, when sold, yield a profit to the seller. The Congress, Treasury, and IRS have improved the administration of the windfall profit tax by defining key terms involved in calculating the tax. To further facilitate windfall profit tax administration, however, the Congress should consider streamlining procedures for issuing tax due notices and appealing IRS decisions to the courts. Treasury and IRS generally agreed with GAO's conclusions and recommendations. 1 figure, 1 table.

45453 **(GAO/RCED—84-51) Improvements needed in the Department of Energy's petroleum pricing and allocation compliance program.** (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 18 Apr 1984. 28p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901490.

Between August 1973 and January 1981 (the date the President lifted price controls on refined petroleum products) the Department of Energy's Economic Regulatory Administration and predecessor federal agencies established and enforced regulations controlling the allocation and pricing of crude oil and refined petroleum products. Through its compliance program, ERA has audited oil companies' compliance with these regulations and has identified alleged violations totaling billions of dollars. GAO found that the overly optimistic workload objectives for ERA's compliance program resulted in understated budgets. GAO questioned whether ERA has adequate assurance that the major refiners' alleged violations are equitably resolved because ERA: has not maintained audit and compliance histories on each major oil refiner, and had not assured that the computer program it uses in settling alleged violations effectively meets its needs. GAO makes recommendations to increase audit coverage and to improve ERA's process for resolving alleged violations.

45454 **(GAO/RCED—84-52) Information on the Department of Energy's budgets for enforcing its petroleum allocation and pricing regulations and its process for distributing oil company overcharge refunds.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 11 Apr 1984. 10p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901532.

The General Accounting Office conducted a review of the Economic Regulatory Administration's (ERA's) budget for enforcing the Department of Energy's (DOE's) petroleum allocation and pricing regulations pursuant to the Emergency Petroleum Allocation Act of 1973. This letter describes this review and also includes information on the Office of Hearings and Appeals' (OHA's) fiscal years 1981 to 1984 budgets and DOE's process for resolving the cases involving funds collected from oil companies in settling alleged violations of DOE's petroleum allocation and pricing regulations. The findings are: (1) ERA has consistently set overly optimistic objectives for its compliance program that resulted in proposed budgets being understated; (2) OHA's fiscal year 1984 workload is greater than anticipated in its budget submission because of ERA's unanticipated referral of 453 oil companies' overcharge refund cases in October 1983 to OHA; and (3) DOE has made slow progress in resolving the cases involving funds collected from oil companies because of higher priority work, the complexity of these oil companies' overcharge refund cases, and ERA's late referral of 453 of these cases.

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 02200045486

0230 Properties

REFER ALSO TO CITATION(S) 02300045358

45455 **Critical properties estimation from an equation of state.** Whitson, C.M. *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE 12634**: 59-70(Apr 1984). (CONF-8304162—).

From 4. SPE/DOE symposium on enhanced oil recovery; Tulsa, OK, USA (16 Apr 1983).

This paper describes a new method for calculating critical properties of petroleum fractions used as input to a cubic equation of state (EOS). The method differs from existing methods in that it forces the EOS to match measured values of boiling point and molar volume (molecular weight divided by specific gravity) for each petroleum fraction. PVT predictions are made with the proposed method using the Peng/Robinson EOS for selected reservoir fluids reported in the literature. Saturation pressure and saturated density are calculated with the EOS and compared with experimentally determined values. Heptanes-plus (C_7^+) fractions are characterized using the proposed method and results indicate that both volumetric and phase behavior are improved. Reservoir fluids used in the study represent a wide range of compositions with PVT properties reported at temperatures ranging from 38-120°C. A new method is suggested for matching experimental saturation pressure with an EOS. Using the proposed method for calculating critical properties, the boiling point of the heaviest petroleum fraction is adjusted until mixture saturation pressure is matched. A near-linear relation exists between boiling point of the heaviest fraction and saturation pressure. It is suggested that this method has more physi-

cal meaning than the common practice of adjusting methane binary interaction coefficients. Proposed methods can be used with any cubic EOS. Critical properties are presented graphically for the Peng/Robinson and Soave/Redlich/Kwong equations. A generalized form of the two-constant cubic EOS is proposed, and necessary expressions for phase and volumetric calculations are given. The critical-property method is diagrammed schematically to facilitate programming. It can be easily incorporated into existing PVT software already based on an EOS.

0240 Storage

45456 **(DOE/FE—0037/2) Strategic Petroleum Reserve quarterly report.** (USDOE Assistant Secretary for Fossil Energy, Washington, DC. Strategic Petroleum Reserve). 15 Aug 1984. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017498.

This August 15, 1984 SPR Quarterly Report, presented in five sections, describes activities undertaken with respect to the development of the Reserve during the period April 1, 1984 through June 30, 1984. The introduction and summary briefly discuss SPR program background and major activities of this quarter. Section II describes site development. Oil acquisition activities are reported in Section III. Other program topics are discussed in Section IV and information on the budget and cost of the Reserve is contained in Section V. The SPR underground storage facilities are being developed in three phases. Phase I, completed in 1980, consisted of the development of approximately 260 million barrels of storage capacity at five sites and construction of the St. James Marine Terminal. Phase II consists of storage capacity expansions at three Phase I sites by a total of 290 million barrels; cavern development is approximately 75 percent complete. Phase III development consists of the construction of a new 140-million barrel storage site at Big Hill, Texas, and the further expansion of three existing SPR storage sites by a total of 60 million barrels. Phase III development is proceeding on schedule with cavern leaching underway at Bryan Mound and surface construction underway at Big Hill. Drilling of the final 18 wells at Big Hill has commenced. Phase III well drilling at West Hackberry was completed during the second quarter of FY 1984, and surface construction will be initiated in August 1984. During the quarter ending June 30, 1984, the total inventory of oil stored in the SPR reached 413,734,620 barrels. The average fill rate during the quarter was 241,116 barrels per day and the weighted average delivered price of crude oil during this quarter was $30.54 per barrel. The projected fill rate for the calendar quarter July 1, 1984 to September 30, 1984, is approximately 197,000 barrels per day. 2 tables.

45457 **(DOE/PO/10850—T2) Offshore oceanographic and environmental monitoring services for the Strategic Petroleum Reserve, June 1983-September 1983. Predisposal physical oceanographic studies for the Big Hill site.** Kelly, F.J.; Randall, R.E.; Schmitz, J.E. (Texas A and M Univ., College Station (USA)). Jul 1984. Contract AC96-83PO10850. 97p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017496.

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A physical oceanographic study was conducted from June through September 1983 in the region of the planned Big Hill brine disposal site which is part of Phase III of the Department of Energy's Strategic Petroleum Reserve Program. The objectives of the study were: (1) to further document and describe the physical environment of this region during the period of the year which has been identified as less favorable for brine dispersion (Randall and Kelly, 1982); (2) to provide data for the planning of baseline studies; (3) to begin to document the interannual variability of this region by comparing the data of this study to those found during the same months in 1978 (Waddell and Hamilton, 1981); and (4) to compare the physical environment at this planned brine disposal site to that at each of the two active brine disposal sites, Bryan Mound and West Hackberry. Following the introduction contents of this report include: (1) methods (hydrographic surveys, in situ instrumentation, meteorological data, and data processing methods for time series); (2) observations; (3) spectral analysis (wind and current, harmonic tidal analysis of currents); (4) persistence analysis of bottom currents; (5) discussion; (6) summary; (7) bibliography; and (8) appendix A - supporting data. 25 references, 40 figures, 16 tables.

45458 **(GAO/RCED—84-12) Additional improvements needed in logistics support for the Strategic Petroleum Reserve.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 13 Apr 1984. 52p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901517.

Planning maintenance and spare parts acquisition activities (logistics support) for equipment associated with large projects, such as the Strategic Petroleum Reserve, should be integrated with the initial design phase of the project to reduce support costs and increase the reliability of the system. This report discusses the delays in the Department of Energy's efforts to develop an integrated logistics support system and the resultant difficulties encountered in acquiring, controlling, and protecting spare and repair parts for the Reserve. The Department has made some improvements in its management of logistics support activities, but an integrated logistics support system for the Reserve still had not been completed as of March 1984. GAO recommends that the Department more closely monitor the development of a new Reserve storage site to ensure that integrated logistics support is fully incorporated prior to the start of operations. It also recommends improvements in the Department's management of its logistics-related contract. 1 figure, 3 tables.

45459 **(GAO/RCED—84-148) Status of strategic petroleum reserve activities as of March 31, 1984.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 13 Apr 1984. 42p. US General Accounting Office, Document Handling and Information Services Facility, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901491.

The Department of Energy reported that the Strategic Petroleum Reserve contained about 391.8 million barrels of oil on March 31, 1984. During the second quarter of fiscal year 1984, about 12.7 million barrels of oil were added for a fill rate of about 140,000 barrels per day. This report discusses the progress being made in filling, developing, and operating the Reserve. It also discusses other events and activities affecting the Reserve that occurred during the second quarter of fiscal year 1984. 2 figures, 12 tables.

45460 **(GAO/RCED—84-182) Status of Strategic Petroleum Reserve activities as of June 30, 1984.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 13 Jul 1984. 33p. US General Accounting Office, Document Handling and Information Services Facility, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901872.

The Department of Energy reported that the Strategic Petroleum Reserve contained about 413.7 million barrels of oil on June 30, 1984. During the third quarter of fiscal year 1984, about 21.9 million barrels of oil were added for a fill rate of about 241,000 barrels per day. This report discusses the progress being made in filling, developing, and operating the Reserve. It also discusses other events and activities affecting the Reserve that occurred during the third quarter of fiscal year 1984. 3 figures, 11 tables.

45461 **German know-how for United States strategic crude oil reserve.** *Oil Gas–European Magazine (English Translation);* 4: No. 2, 41-42(1978).

Kavernen Bau- and Betriebs-G.m.b.H. has a design contract from the U.S. Department of Energy within the strategic petroleum reserve program. The oil will be stored on the gulf coast of Texas and Louisiana where solution mined cavities already exist, and there are salt domes which can be leached. The cavities are located at depths between 300 and 1800 m. The contract, worth more than $15 million at the end of July 1978, covers the technical equipment and construction concepts for a storage volume of 26 million tons of crude oil. The reserve is to cover a 180 day import interruption, with 35 million tons to be stored by the end of 1978, and double this amount by the end of 1980.

03 NATURAL GAS

0301 Reserves

REFER ALSO TO CITATION(S) 03010045404

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 03020045405, 45406, 45407, 45408, 45409, 45410, 45411, 45412, 45413, 45414, 45417, 45418, 45423, 45478, 45484, 45874, 46757, 46768, 46772, 46782

45462 (CONF-8203181—Summs., pp 10-11) **Petrology and diagenesis of the gas-bearing Tuscarora sandstone, Kanawha County, West Virginia.** Bruner, K.R.; Heald, M.T. (West Virginia Univ., Morgantown). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

In west-central West Virginia, the Lower Silurian Tuscarora is a fine-grained-to-conglomeratic orthoquartzite that apparently formed in a transitional marine environment. It is of particular interest because of its production of gas which is commonly rich in CO_2. This study is primarily concerned with diagenetic processes and porosity development of the Tuscarora based on a core from the David Ward No. 64 Well (Kan 2751). In this core, the Tuscarora is 94 feet thick, of which the lower 51 feet was cored.

45463 (CONF-8203181—Summs., pp 19-20) **Oriskany sandstone: regional stratigraphic relationships and production characteristics.** Diecchio, R.J.; Jones, S.E.; Dennison, J.M. (George Mason Univ., Fairfax, VA; Univ. of North Carolina, Chapel Hill). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

This report was compiled from available literature on the Lower Devonian Oriskany (Ridgeley) Sandstone throughout its full extent from northeastern Tennessee to eastern New York, and from western Virginia to eastern Ohio. The Oriskany, which represents the Deerpark Stage of the Devonian, is one of the major gas producers in the Central Appalachian basin. Typically, the Oriskany is a calcareous quartzarenite with a distinctive megascopic fauna. Locally the Oriskany is orthoquartzitic, and in places conglomeratic. In outcrop, leaching of the calcareous components of the Oriskany produces a more friable, biomoldic quartzarenite. This is not typical in the subsurface where the formation is usally tightly cemented by carbonate. Facies variations within the Deerpark interval are responsible for the Oriskany grading laterally into limestone (Glenerie of New York) and chert (upper Shriver of Pennsylvania). The Oriskany reaches a maximum thickness of over 100 meters in western Maryland and thins to zero toward the north, west, and south. Most production from the Oriskany has been in the form of natural gas. Oil, however, is produced from the Oriskany in eastern Ohio, and shows of oil are known in western West Virginia and the southern tier of New York. Many of the older Oriskany fields are today either abandoned or used as gas storage fields. To date, the Oriskany has been most productive in Pennsylvania, West Virginia, Ohio, and New York. Minor production has taken place in westernmost Maryland and northwestern Virginia.

45464 (CONF-8203181—Summs., pp 32-33) **Effects of diagenetic changes in sandstone reservoirs.** Heald, M.T. (West Virginia Univ., Morgantown). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

Recognition of diagenetic features can be important in exploration for hydrocarbons. The coatings which are important in preserving porosity may be very thin and easily overlooked, but can be detected by abnormal growths on quartz. The original sedimentary environment of deposition may set the stage for later diagenetic changes. As an example, fluvial reducing environments are favorable for formation of chlorite coatings which favor preservation of porosity. On the other hand, marine conditions may lead to the formation of illite with attending pressure solution and the loss of porosity. Information on the types of coatings is also important in well treatment so that the effects of interaction with fluids will be known.

45465 (CONF-8203181—Summs., pp 34-35) **Exploration and reservoir characteristics of Onondaga bioherms.** Kissling, D.L.; Polasek, J.F. Jr. (ERCO Petroleum Services, Inc., Houston, TX; Amoco Production Co., Houston, TX). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

To date, six gas-producing and one shut-in Onondaga bioherm fields are known from New York and Pennsylvania. As of January, 1981, nine wells have produced more than 18 Bcfg for a per well average of two Bcfg. Onondaga bioherms cover 300 to more than 700 acres and display 110 to 200 feet vertical buildup. Amoco No. 1 Witco, penetrating Cyclone Reef, has a net pay thickness of 25 feet and average net porosity and water saturation of 4.3% and 26%, respectively. Values for other bioherms are comparable. Reserve calculations and pressure tests indicate that Amoco No. 1 Witco will produce at least 90% of the original gas in place (OGIP). It is apparent that the natural fracture system, combined with the remaining primary and secondary porosity and that enhanced by acid fracing, provide the lateral and vertical permeability to thoroughly draw the reservoirs. Cost-effective exploration for Onondaga bioherms should employ seismic reflection only to confirm specific trends or sites previously delineated by thorough petrographic survey and facies analysis. Additional bioherms should be discovered by the dual approach of (1) analysis of basal Edgecliff facies to delimit the positions of crinoid banks or shoals on which bioherms were initiated, and (2) analysis of Moorehouse facies to reveal the presence of nearby, yet-undiscovered bioherms at the time of their maximum development. Pre-Onondaga paleogeology and Edgecliff and Nedrow isopach maps support the first approach by providing collaborative evidence for paleobathymetry. By the second approach, coral assemblages and indicator lithologic associations allow prediction of bioherm proximity within one mile of samples.

45466 (CONF-8203181—Summs., pp 48) **Lineaments as exploration tools for natural gas in Martin County, Kentucky.** Rauch, H.W.; Ragan, J.; Newton, D. (West Virginia Univ., Morgantown; Texaco Inc., New Orleans, LA). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

A lineament study was conducted in the Big Sandy gas field in Martin County, Kentucky. About 800 gas wells were examined for relationships between mapped lineaments and gas production (isopotential) from the Devonian shales, Big Lime unit, Maxon sandstone, and Salt sands (Pottsville Group). Most major gas production in Martin County is derived from the Devonian shales, and most such shale wells are commercial producers instead of dry holes. Results indicate that shale gas production can be significantly enhanced by locating wells within 0.10 km and especially within 0.04 km of a northeast-oriented short straight photolineament plotted on a topographic map or photograph. Such wells produce at up to double the average rate for all shale wells. Short curvilineaments show no significant associations with shale gas yield. Shale gas wells exhibit higher yields near long lineaments oriented northeast, but statistical trends are not as strong as for the short straight photolineaments. Overall, intelligent use of lineaments should significantly improve on gas exploration results, with success rates up to approximately double those for average wells in terms of percentage of producing wells or average (median) yield for all wells, at least for Martin County.

45467 (CONF-8203181—Summs., pp 49) **Current update of the status of tight formation designations in the Appalachian Basin from New York to Tennessee.** Rothman, E.M. (Columbia Gas Transmission Corp., Charleston, WV). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

A tight formation, as defined in Order No. 99 of the Federal Energy Regulatory Commission (FERC), is a tightly cemented reservoir rock with low permeability. Due to the tight characteristics of the formation, additional, more expensive stimulation techniques are required to produce gas from the reservoir. To encourage operators to drill new wells and recomplete old wells from tight formations, FERC classified tight formation gas in the Natural Gas Policy Act (NGPA) as 107, which allows a higher price to be obtained. Order No. 99 states tight formations should be studied under the jurisdiction of the proper state agencies. After the state approves the tight formation designated areas, the state's recommendations are submitted to FERC for approval. To date, five tight formation reports have been approved in the Appalachian Basin. The Clinton sandstone in eastern Ohio; the Ravencliff sandstone, Injun-Squaw sandstone, Weir sandstone and Berea Sandstone in Fayette and Raleigh Counties, West Virginia; the Medina Sandstone in five northwestern counties of Pennsylvania; the Berea Sandstone in the plateau of western Virginia; and the Medina Sandstone of Chautauqua and Cattaraugus Counties, New York have been designated tight formations by FERC. Additional tight formation approvals are forthcoming in Kentucky, Ohio, Tennessee, New York, Pennsylvania, and West Virginia.

45468 (CONF-8203181—Summs., pp 53) **Carbonate lithofacies and natural gas in the Devonian Helderberg Formation, Eastern Kentucky.** Smosna, R. (West Virginia Univ., Morgantown). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

A 40 m (130 ft) core of the Helderberg Formation in Johnson County contains many thin zones of natural gas and hydrogen sulfide. The entire Corniferous Group in this well, including the Helderberg carbonates, was treated and initial production was 464 MCFGPD. Porosity is generally poor throughout the formation but is as high as 9% in some zones. Porosity occurs as micropores (50 μ) associtaed with dolomization, mesopores (up to 5 mm) thought to be solution-enlarged molds of carbonate grains and evaporite minerals, horizontal fractures along bedding planes and stylolites, and incompletely filled vertical fractures. Horizontal permeability is fair, ranging from 1 to 36 md along horizontal fractures. Vertical permeability, however, is poor due to interbedded non-porous dolomites, shale laminae, stylolites, and occasional hardgrounds.

45469 (CONF-8203181—Summs., pp 62) **Nature of porosity in the Lower Silurian Tuscarora Sandstone.** Wescott, W.A. (Amoco Production Co., Houston, TX). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

The Tuscarora Sandstone, a classic orthoquartzite, is one of the major exploration targets in the Appalachian Basin. Although the formation has proved gas productive in some areas, it is generally tight. Future exploration successes in the Tuscarora Sandstone will be due to understanding the nature and distribution of porosity in this tight formation. Four major porosity types have been recognized in the Tuscarora Sandstone: (1) intergranular porosity; (2) moldic secondary porosity; (3) microporosity; and (4) fracture porosity. Continued exploration for natural gas in the Tuscarora Sandstone will require detailed rock studies, identification and mapping of porosity types, and the delineation of favorable porosity trends.

45470 (CONF-8203181—Summs., pp 63) **Roane County, West Virginia tight formations.** Woofter, L. (West Virginia Univ., Morgantown). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

45471 (DOE/MC/08705—T1) **Prediction of in-situ stresses from directional properties of rock cores for field development of Devonian shales. Final report.** Peng, S.S.; Okubo, S. (West Virginia Univ., Morgantown (USA). Coll. of Mineral and Energy Resources). Jul 1978. Contract AT21-77MC08705. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017559.

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The directional properties of Devonian Shale were determined through five physical property measurements: ultrasonic velocity measurement, point load test, Brazilian test, measurement of directional elastic constants and elastic property variation in the horizontal plane. The core, with a total length of 1300 feet (Depth 2720 to 4026 feet) was taken from Well # 20403 in Lincoln County, WV. The results show that: bedding planes are quite distinct, and the most preferred direction of fractures in the bedding plane is N60°E.

45472 (DOE/MC/08725—T1) **Fracture intensity predictions for eastern gas shales. Final report.** Wheeler, R.L. (West Virginia Univ., Morgantown (USA)). Dec 1978. Contract AT21-78MC08725. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017586.

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Exploration rationales were developed for extending Devonian shale exploration eastward in West Virginia and adjacent states, away from present production, toward and into the central and eastern Plateau province where the shales are deeper, mostly involved in detached tectonics, and little tested or untested. One rationale predicts more fracture rock over the eastern and western border faults of the Rome trough, particularly in and near Kanawha County, West Virginia. The second is a two-step rationale. First broad areas or stratigraphic intervals that are thermally mature, and have adundant organic carbon derived from nonmarine sources. Second, use a newly developed estimator of joint surface area per unit volume or rock (intensity), and of intensity's uncertainty, to select specific drilling sites by examining exposed analogues of subsurface structures that are being considered for further exploration. Specifically, cross-strike structural discontinuities (CSDs) are alignments of disruptions in structural or geomorphic patterns, and contain on the order of 1000 cubic km of intensely jointed rock. Within areas outlined by this approach, drill on intersections of short air-photo lineaments in CSDs, east of the western limit of detachment in or below the Devonian shales.

45473 (DOE/METC/SP—211) **Deep Source Gas Project.** (Department of Energy, Morgantown, WV (USA). Morgantown Energy Technology Center). Feb 1984. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84009249.

The objectives of the Deep Source Gas project are to establish the existence of natural gas arising from depths in excess of 30,000 feet, to relate these occurrences to conceptual models, to define the limits of target areas, to quantify the resource, and to determine the significance of the gas to the nation's reserves. An outline of the research plan to accomplish the above objectives is presented, focused to an earth science (geology, geochemistry, and geophysics) study of the Cordilleran Geologic Province of western North America. This area is considered prospective largely due to known and suspected plate tectonic structures and their youthful emplacement (i.e., during the last 180 million years), which increases the likelihood of a timely entrapment of deep source generated hydrocarbons. Significant project results include: (1) an estimate of the deep source gas generating capacity of the Aleutian Trench area of southern Alaska (up to 212 trillion cubic feet (Tcf) during the last 20 million years alone) based on detailed geochemical studies; and (2) deep geophysical study findings of apparent fossil subduction zones (predicted to occur in the Cordillera) in western Washington. Significantly, these zones appear to have very thick sedimentary rock units, the existence of which will be evaluated through a future, more detailed seismic study and possible drilling activities. A list of future activities is included, which presents the development of a critically needed detection and differentiation system to enable segregation of suspected deep subducted origin gas from other possible sources. 13 figures.

45474 **Subducted organically derived gas: a new research direction in unconventional deep-source gas.** Gwilliam, W.J. (Morgantown Energy Tech. Center, WV). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **14**: vp(1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Paper 829183.

Recently evolved concepts of plate tectonics suggest that the subduction of organic ocean sediments, at the margins of moving crustal plates, may have recharged the earth's mantle with methane and other carbon compounds. The sediments would have been subjected to frictional forces and increasing depth of burial with the subduction zone, becoming progressively more mature source beds for natural gas. This theory provides an organic basis for the deep methane deposits, disclaiming the popular notion that they are abiogenetic in origin.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 03030045379, 45405, 45408, 45412, 45416, 45418, 45419, 45420, 45421, 45422, 45423, 45463, 45465, 45468

45475 (CONF-8203181—Summs., pp 37) **High-potential gas production and fracture-controlled porosity in the Upper Devonian Kane sand, central-western Pennsylvania.** Laughrey, C.D. (Pennsylvania Geological Survey, Pittsburgh). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

45476 (CONF-8203181—Summs., pp 50) **Oriskany matrix porosity in southwest-central Pennsylvania.** Sanders, A.W. (Amoco Production Co., Houston, TX). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

A study of well logs, cores, borehole televiewer logs, and production data from more than 50 Oriskany Sandstone tests in southwest-central Pennsylvania indicates that: (1) matrix porosity must be present to recover economic reserves; and (2) log evaluation is more effective than initial potential in indicating well reserves and therefore, in determining appropriate completion procedures. While fractures are typically present and needed for reservoir deliverability, they commonly provide little reservoir capacity. Matrix porosity must be present to recover economic reserves. A definite relationship between recoverable gas reserves and calculated phi h (porosity-feet) exists. Mapping phi h for different sandstone units in the Oriskany Formation will locate those areas where economic production will be present and those areas most likely to have the largest per-well gas reserves.

45477 (CONF-8203181—Summs., pp 51) **Oil and gas developments in Maryland in 1981.** Schwarz, K.A. (Johns Hopkins Univ., Baltimore, MD). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

45478 (CONF-8203181—Summs., pp 52) **Technology issues associated with evaluation, stimulation, and production of Devonian shale wells in the Appalachian Basin.** Shuck, L.Z. (Technology Development Inc., Morgantown, WV). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

0305 Health And Safety

45479 **(UCRL—53411) Accidental releases of sour gas from wells and collection pipelines in the Overthrust Belt: calculating and assessing potential health and environmental risks.** Layton, D.W.; Cederwall, R.T.; Ricker, Y.E.; Shinn, J.H.; O'Banion, K.D. (Lawrence Livermore National Lab., CA (USA)). 15 Apr 1983. Contract W-7405-ENG-48. 140p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84017286.

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Parts of the Overthrust Belt of western Wyoming and adjoining areas in Utah and Idaho contain geologic formations with significant accumulations of oil and natural gas. Some of these formations, though, yield gas that is contaminated with toxic hydrogen sulfide. The process of assessing the health risks of a potential sour-gas release involves estimation of the emission rate of hydrogen sulfide, specification of how the gas is released (e.g., vertically into the atmosphere or horizontally), prediction of downwind concentrations of the gas, analysis of the potential health effects, and finally, review of safety methods required to minimize the potential health risks. The first part of the report includes an analysis of data on the health effects of hydrogen sulfide to determine the nature of its dose-response relationship. Following that review is a study of the different methods of quantifying the emission rate of gas from wells and pipelines. Data on the frequency of accidental releases from those faciliies are also analyzed. To assess the health risks of an accidental release from a well under BLM supervision located near Evanston, we collected meteorological data for 1 y from four stations in that area. Our analysis of a worst-case release scenario (i.e., a gas plume that is near the surface) using those data indicates that the greatest risks of incurring an acute health effect (e.g., unconsciousness, respiratory arrest, pulmonary edema, or death) are located in the northwest sector downwind from the well because of the occurrence of stable atmospheric conditions along with slow winds from the southeast. The risks of an acute health effect in that northwest sector over the 20-y operation of the well were on the order of 10^{-4} to 10^{-5} - similar to the risk of accidental death caused by a natural disaster over the same period. 103 references, 12 figures, 21 tables.

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 03060045386, 45445, 46089

45480 **(DOE/EIA—0130(84/06)) Natural Gas Monthly, June 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Aug 1984. 151p. NTIS, PC A08/MF A01; 1 - GPO; GPO Dep. File Number DE84016489.

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This report highlights activities, events, and analyses of natural gas production and consumption statistics during June, 1984. Data are presented on the following topics: natural gas production and distribution in the US; marketed production by state; supplemental and natural gas consumption; underground natural gas storage in the US; natural gas prices; pipeline company revenues; expenses and income; well determination filings; and estimated surplus of natural gas. 5 figures, 24 tables. (DMC)

0308 Environmental Effects

REFER ALSO TO CITATION(S) 03080045479

45481 **(UCRL—53530) Vapor burn analysis for the Coyote series LNG spill experiments.** Rodean, H.C.; Hogan, W.J.; Urtiew, P.A.; Goldwire, H.C. Jr.; McRae, T.G.; Morgan, D.L. Jr. (Lawrence Livermore National Lab., CA (USA)). Apr 1984. Contract W-7405-ENG-48. 89p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017288.

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A major purpose of the Coyote series of field experiments at China Lake, California, in 1981 was to study the burning of vapor clouds from spills of liquefied natural gas (LNG) on water. Extensive arrays of instrumentation were deployed to obtain micrometeorological, gas concentration, and fire-related data. The instrumentation included in situ sensors of various types, high-speed motion picture cameras, and infrared (IR) imagers. Five of the total of ten Coyote spill experiments investigated vapor burns. The first vapor-burn experiment, Coyote 2, was done with a small spill of LNG to assess instrument capability and survivability in vapor cloud fires. The emphasis in this report is on the other four vapor-burn experiments: Coyotes 3, 5, 6, and 7. The data are analyzed to determine fire spread, flame propagation, and heat flux - quantities that are related to the determination of the damage zone for vapor burns. The results of the analyses are given here. 20 references, 57 figures, 7 tables.

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 03090045384, 45385, 45386, 45472, 46790

45482 (DOE/MC/08710—T1) Fracture mechanics investigations associated with coring and hydraulic induced fractures. Advani, S.H.; GangaRao, H.V.S. (West Virginia Univ., Morgantown (USA). Coll. of Engineering). [1984]. Contract AT21-77MC08710. 116p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84017557.

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Results from research on the simulation of hydraulic fracture models are presented. These models include the characterization of the coupled formation structural and fracturing fluid flow responses. The structural model is represented by layered linear elastic media subjected to in situ stress fields and fluid pressure on the vertical crack surface. The flow model includes the effects of flow rate, pumping pressure, fluid viscosity, fluid compressibility and formation reservoir properties. Predictive results for the estimation of the fracture width and area for selected Devonian shale formation properties and hydraulic fracturing treatment parameters are illustrated. In addition, design considerations related to penetration of cracks across layered media, bottom hole treatment pressure control, in situ stress effects, fluid leak-offs in the formation, and foam fracturing are discussed.

45483 Offset well test: an engineering study of Devonian shale production characteristics. Frohne, K.H.; Komar, C.A. (Dept. of Energy, Washington, DC). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **17**: vp(1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Paper 829177.

A reservoir interference test conducted in an established shale-gas field quantitatively determined the gas-production characteristics of the naturally fractured Devonian shale formation. From an established producing well and two newly drilled monitoring wells offsetting the producer on the secondary and primary regional fracture trends, engineers investigated the following reservoir properties: 1) gas flow characteristics, 2) orientation and distribution of the natural fractures, 3) gas storage and release mechanisms, and 4) the impact of directional flow on production practices. The test results indicate extreme reservoir permeability anisotropy, suggesting that the preferential well drainage pattern of the fractured shale is elliptical. Virtually all of the free gas is sorbed in the matrix, and natural fractures primarily provide conduits for gas transport. These findings affect infill drilling considerations and overall gas recovery efficiency from fractured shale.

45484 Multi-well experiment: a field laboratory for tight gas sands research. Northrop, D.A.; Sattler, A.R. (Sandia National Lab., Albuquerque, NM). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **17**: vp(1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Paper 829175.

Through the multiwell field experiment, researchers hope to determine the viability of the lenticular tight-gas resource of the Western US by characterizing the geology of these sands and developing the technology for their production. To date, two 8350-ft wells, 135 ft apart, have been drilled in the Piceance basin at a site near Rifle, Colo., where the Mesaverde formation lies at a depth of 3900-8300 ft. Preliminary core, log, and well data have provided an initial characterization of the site. Four years of stimulation experiments are planned for this field laboratory.

45485 Economically recoverable gas from Devonian shales in the Appalachian Basin. Pulle, C.V.; Seskus, A.P. (Getty Oil Company). pp 550-560 of Proceedings of the 1981 international gas research conference. Rockville, MD, USA; Government Institutes, Inc. (1982). (CONF-810909—).

From International gas research conference; Los Angeles, CA, USA (28 Sep 1981).

Actual production data for over 1500 shale wells are analyzed to obtain the distribution of well productivity in "training" or mature areas of the basin where the geological and reservoir characteristics are fairly well known and understood. Extrapolation to "target" areas of the basin, where the geology is less characterized and having no historical production data, is performed using a cluster analysis and a Delphi estimating process. It is established that well productivity on a county and regional basis is lognormally distributed. The total economically recoverable gas is Normally distributed with a mean of 20.2 TCF and a standard deviation of 1.6 TCF. The estimates are conditional on the use of "shooting" technology on a 160-acre well spacing.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 03100045486

0320 Transport, Pipelines, And Handling

45486 (GAO/RCED—84-102) Need to assess Federal role in regulating and enforcing pipeline safety. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 10 Jul 1984. 104p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901873.

In the United States there are approximately one and three-quarter million miles of pipelines subject to federal safety standards. These pipelines are used to move nearly all the natural gas and about one-half of the petroleum and petroleum products transported annually. The Department of Transportation is responsible for inspecting both interstate and intrastate pipeline operators, but the law allows the states to assume this responsibility for all or some of the intrastate operators. To assume this responsibility, the states must agree to enforce the federal safety standards. The Department has not provided adequate inspection coverage of the interstate and intrastate pipeline operators for which it is responsible. Also, the Department does not have a viable means of requiring states to assume greater responsibility for intrastate operators or to improve their inspection programs. Most states indicated that they lack the resources needed to assume responsibility for all intrastate gas operators or the intrastate hazardous liquids operators which the federal safety standards will cover beginning sometime in 1984. In fact, some states have reduced their inspection activity, and a few are considering dropping out of the program. Therefore, the Department's inspection workload is likely to increase. GAO is recommending that the Department present to the appropriate congressional committees alternatives for better aligning federal program responsibilities and inspection resources. GAO also is making recommendations for improving the Department's own inspection activities and its evaluations of the states' pipeline safety programs.

0330 Properties

REFER ALSO TO CITATION(S) 03300045353

0340 Combustion

REFER ALSO TO CITATION(S) 03400046171

04 OIL SHALES AND TAR SANDS

0401 Reserves And Exploration

REFER ALSO TO CITATION(S) 04010045485

0402 Site Geology And Hydrology

REFER ALSO TO CITATION(S) 04020045471, 45472

0403 Drilling, Fracturing, And Mining

REFER ALSO TO CITATION(S) 04030045482

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 04040045489

0405 Properties And Composition

REFER ALSO TO CITATION(S) 04050045349, 45358

45487 **A time-temperature-concentration matrix for induced sediment formation in shale diesel fuel.** Cooney, J.V.; Beal, E.J.; Hazlett, R.N. (Naval Research Lab., Washington, DC). *American Chemical Society, Division of Petroleum Chemistry, Preprints;* 28: No. 5, 1139-1144(Sep 1983). (CONF-830814—).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

Deterioration in fuel quality with time has been a continuing problem in the utilization of middle distillate fuels. These stability problems will intensify as we develop alternative sources of fuel, such as shale oil and coal. Present knowledge has suggested that for some fuels, nitrogen heterocycles may play a causative role in the formation of insoluble sediments and gums under conditions of ambient and accelerated storage. In light of the high costs of fuel processing, substantial savings could be realized if it were possible to identify those nitrogen heterocycles which are most actively involved in the formation of insoluble material. Currently, it appears that relatively non-basic nitrogen heterocycles, particularly those which contain alkyl groups in certain positions, may be the most troublesome. However, in other fuels and under different test conditions, basic nitrogen compounds may play a significant role. In addressing this subject, we are defining the stability of shale-derived diesel fuel marine (DFM), stressing the sample under accelerated storage conditions, and determining the amount of total insoluble material produced. This report describes results obtained when 2,5-dimethylpyrrole (DMP) was used as a dopant in a time-temperature-concentration matrix. Results of a survey of other nitrogen compounds as fuel additives are also presented.

0407 Health And Safety

REFER ALSO TO CITATION(S) 04070046748, 46749

45488 **Cytotoxic and mutagenic properties of shale oil by-products. II. Comparison of mutagenic effects at five genetic markers induced by retort process water plus near ultraviolet light in Chinese hamster ovary cells.** Chen, D.J.C.; Strniste, G.F. (Los Alamos National Lab., NM). *Environmental Mutagenesis;* 4: 457-467(1982).

A Chinese hamster ovary (CHO) cell line heterozygous at the adenine phosphoribosyl transferase (APRT) locus was used for selection of induced mutants resistant to 8-azaadenine (8AA), 6-thioguanine (6TG), ouabain (OUA), emetine (EMT) and diphtheria toxin (DIP). The expression times necessary for optimizing the number of mutants recovered at the different loci have been determined using the known direct acting mutagen, far ultraviolet light (FUV), and a complex aqueous organic mixture (shale oil process water) activated with near ultraviolet light (NUV). The results indicate that optimal expression times following treatment with either mutagen was between 2 and 8 days. For CHO cells treated with shale oil process water and subsequently exposed to NUV a linear dose response for mutant induction was observed for all five genetic loci. At 10% surviving fraction of cells, between 35- and 130-fold increases above backgound mutation frequencies were observed for the various markers examined.

0408 Marketing And Economics

45489 **(GAO/RCED—84-187) Plans to award additional financial assistance to the Union Oil Company oil shale program.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 23 Jul 1984. 36p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901870.

The US Synthetic Fuels Corporation plans to provide up to $2.7 billion in assistance to Union Oil Company of California for phase II of its oil shale program. Union's phase I project had been guaranteed up to $400 million in assistance in July 1981. This report provides answers to a number of specific programmatic, financial, and technical questions concerning both the phase I and phase II projects.

05 NUCLEAR FUELS

0502 Exploration

45490 **(GJBX—6(84)) Geochemical characterization of the Mt. Harvard 15-minute quadrangle, Colorado, using NURE data.** Ludlam, J.R. (Bendix Field Engineering Corp., Grand Junction, CO (USA). Grand Junction Operations). Sep 1984. Contract AC07-76GJ01664. 50p. US Geological Survey-Open-File Services Section, P.O. Box 25046, Federal Center, Denver, CO 80225. File Number TI84016744.

The geochemical characteristics of the Mt. Harvard 15-minute quadrangle, Colorado, were identified using data from National Uranium Resource Evaluation (NURE) detailed and reconnaissance geochemical and geophysical surveys. Statistical and cartographic techniques developed during the NURE program were applied to the data, and the results were compared with published geologic mapping, geologic studies, and mineral-occurrence information. Interpretations based on these comparisons resulted in the identification of distinct geochemical environments which represent differing rock types, geologic structures, and mineral-occurrence or -deposit areas. Fifteen areas that have geochemical characteristics indicative of mineral deposits were delineated in this study. Nine of the areas contain elemental data that indicate known and potential base- and precious-metal deposits; four of the areas contain elemental data indicative of uranium deposits; and two of the areas contain data indicative of pegmatite deposits.

0503 Mining

REFER ALSO TO CITATION(S) 05030045584

45491 (ARL/TR—060, pp 4-7) **Measurement of unattached fractions in open-pit uranium mines.** Solomon, S.B.; Wise, K.N. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

A preliminary set of measurements of the unattached fraction of potential alpha energy was made at the Ranger open pit uranium uranium mine and the Nabarlek uranium mill. The measurement system, which incorporated a parallel plate diffusion battery and diffuse junction detectors, is described. Results for RaA show a wide variation in the unattached fraction. They range up to 0.76 and are higher than corresponding values for underground mining operations.

45492 (ARL/TR—060, pp 8-11) **Variation of radon daughter concentrations in open-pit uranium mines.** Solomon, S. B.; Osborne, M. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

In order to quantify the WL variations for open pit mine conditions, a series of measurements was made at the Ranger uranium mine over a two week period. The parameters measured were temperature, wind speed, radon and radon daughter concentration and WL. A preliminary analysis of the data shows a correlation between WL and the reciprocal wind speed but no apparent correlation between wind speed and the equilibrium factor.

45493 (ARL/TR—060, pp 12-14) **Accuracy of single count methods of WL determination for open-pit uranium mines.** Solomon, S.B.; Kennedy, K. N. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

A study of single count methods of WL determination was made using a database respresentative of Australian open pit uranium mine conditions. The aim of the study was to check the existence of the optimum time delay corresponding to the Rolle method, to determine the accuracy of the conversion factor for Australian conditions and to examine any systematic use of data bases of representative radon daughter concentration.

45494 (SAND—84-1728C) **Pumping test design for characterization of in-situ leaching uranium mines.** Beauheim, R.L.; Popielak, R.S. (IT Corp., Albuquerque, NM (USA); Canonie Engineers, Englewood, CO (USA)). 1984. Contract AC04-76DP00789. 14p. (CONF-840890—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016221.

From Impact of mining on groundwater conference; Denver, CO, USA (27 Aug 1984).

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In-situ leaching license applications to the NRC and state agencies require substantial hydrogeologic data, including ore zone transmissivity, storativity, and horizontal anisotropy (or directional transmissivity) and vertical anisotropy, as well as the vertical hydraulic conductivity and storativity of aquitards. Three theories can be combined to design a pumping test capable of providing data on the three-dimensional properties of aquifers and aquitards. These theories pertain to partially penetrating wells, horizontal anisotropy, and aquitard responses to pumping in aquifers. Requirements for the pumping test include a partially penetrating pumping well, three observation wells completed at the top and bottom of the aquifer, and aquitard piezometers completed at the same distances and orientations with respect to the pumping well as the upper and lower observation wells. This type of pumping test will provide most of the data required by the NRC to assess the practicability of aquifer restoration plans. 12 references, 7 figures, 1 table.

0504 Feed Processing

REFER ALSO TO CITATION(S) 05040045582

45495 (ARL/TR—060, pp 22-24) **Survey of radon emanation rates at Port Pirie tailings dams.** Gan, T.H.; Mason, G.C.; Wise, K.N. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

A survey was carried out to determine radon emanation rates from tailings at a plant used for extraction of uranium from concentrates between 1955 and 1961 and for extraction of rare earth elements from monazite sands between 1969 and 1972. The total emanation rate for all dams at the plant was determined to be 460 +-90 KBq/s. There was an enhanced radon flux following rain. Typical values lay between .7 and 1 $Bqm^{-2}s^{-1}$ under dry conditions and rose to about 9 $Bqm^{-2}s^{-1}$ a few hours after rain.

45496 (ARL/TR—060, pp 25-28) **Variations in radon emanation with moisture content.** Gan, T.H.; Leach, V.A. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

Some preliminary results of the effects of moisture content on volume emanation rates and emanation coefficients are presented for core and crushed samples of cemented tailings. The volume emanation rates increased with increasing moisture content, with saturated core samples emanating about 3 times as much as dry material. There was a similar increase in coefficient for the crushed cemented tailings.

45497 **Method and set-up for uranium ore sorting.** Dragulescu, E.; Ivascu, M.; Popescu, D.; Semenescu, G. (Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania)); Gherea, Gh. (Intreprinderea metalelor rare, Bucuresti (Romania)); Draga, Z.; Funaru, Gh. (Exploatarea miniera Oravita, Oravita (Romania)). *Studii si Cercetari de Fizica;* **33**: No. 4, 415-419(1981). (In Romanian).

A method was studied for uranium ore sorting. After the discussion of the principle, some particular conditions of the sorting are pointed out. A radiometric assembly is described and some results obtained on the simulator and in industrial conditions are reported.

0505 Enrichment

45498 (K/TS—10-885) **Solution of the h-equation for a single point source excitation of magnitude K.** Johnson, R.O. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Aug 1984. Contract AC05-84OT21400. 46p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017574.

An analytic solution to the equation 4A ⁴h/sub xx/ + h/sub yy/ = K δ(x-x*)δ(y-y*) is determined using standard methods for partial differential equations. Nonhomogeneous boundary conditions complicate the solution considerably. The actual boundary conditions employed include a linear temperature distribution along the centrifuge wall, constant end cap temperatures, and an upper atmosphere that is insulated. This solution can be used in conjunction with existing solutions to the Pancake equation to calculate primitive variables. 14 references, 3 figures.

45499 **Novel 15.9-micron source.** Buchwald, M.I.; Jones, C.R. (Los Alamos National Lab., NM). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **380**: 169-172(1983). (CONF-830425—).

From Society of Photo-Optical Instrumentation Engineers conference; Santa Fe, NM, USA (11 Apr 1983).

Laser emission has been generated in $^{15}ND_3$ by pumping at 860.4 cm^{-1}. Strong laser action has been observed at 123 cm^{-1}, 109 cm^{-1} and, with up to 10 millijoules extracted, at 628.1 cm^{-1}. Spectroscopic analysis indicates that the pumping arises from, and the 628.1 cm^{-1} emission terminates on, the same rotational state. Analysis of the time histories of the three laser emissions as well as studies of laser output energies indicates that 15.9-micron output arises from a 4-wave type process. This system, in addition, clarifies the interpretation of earlier studies of CO_2-laser-pumped ammonia lasers.

0506 By-products

REFER ALSO TO CITATION(S) 05060045617

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 05070046331, 47145, 47146, 47159, 47181

45500 (DP—1688) **Production of U_3O_8 by uranyl formate precipitation and calcination in a full-scale pilot facility.** Kendrick, L.S.; Wilson, W.A.; Mosley, W.C. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Aug 1984. Contract AC09-76SR00001. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001772.

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The uranyl formate process for the production of U_3O_8 with a controlled particle size has been extensively studied on a laboratory scale. Based on this study, a pilot-scale facility (the Uranyl Formate Facility) was built to investigate the key steps of the process

on a larger scale. These steps were the precipitation of a uranyl formate monohydrate salt and the calcination of this salt to U_3O_8. Tests of the facility and process were conducted at conditions recommended by the laboratory-scale studies for a full-scale production facility. These tests demonstrated that U_3O_8 of the required particle size for the PM process can be produced on a plant scale by the calcination of uranyl formate crystals. The performance of the U_3O_8 produced by the uranyl formate process in fuel tube fabrication was also investigated. Small-scale extrusion tests of U_3O_8-Al cores which used the U_3O_8 produced in the Uranyl Formate Facility were conducted. These tests demonstrated that the U_3O_8 quality was satisfactory for the PM process.

45501 **(LA—10133-MS) Evaluation of the reliability of several techniques for the measurement of the volume fraction of second-phase material.** Johnson, K.A. (Los Alamos National Lab., NM (USA)). Aug 1984. Contract W-7405-ENG-36. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016979.

Automatic image analysis results are compared with the results of manual analyses. A number of technicians and several materials were used to generate the data. In addition, a calculation method for determination of the number of areas or photomicrographs needed to characterize a sample and/or a batch is presented.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 05080045521, 45522, 46327

45502 **(CONF-840802—15) Solvent degradation and cleanup: a survey and recent ORNL studies.** Mailen, J.C.; Tallent, O.K. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016712.

From International topical meeting on fuel reprocessing and waste management; Jackson Hole, WY, USA (26 Aug 1984).

This paper surveys the mechanisms for degradation of the tributyl phosphate and diluent components of Purex solvent by acid and radiation, reviews the problems encountered in plant operations resulting from the presence of these degradation products, and discusses methods for minimizing the formation of degradation products and accomplishing their removal. Scrubbing solutions containing sodium carbonate or hydroxylamine salts and secondary cleanup of solvents using solid sorbents are evaluated. Finally, recommendations for improved solvent cleanup are presented. 50 references, 4 figures, 3 tables.

45503 **(CONF-840802—16) Dissolution of low burnup Fast Flux Test reactor fuel.** Fellows, R.L.; Campbell, D.O.; Mailen, J.C. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016711.

From International topical meeting on fuel reprocessing and waste management; Jackson Hole, WY, USA (26 Aug 1984).

The first Fast-Flux Test Facility reactor fuel [mixed $(U,Pu)O_2$ composition] has been used in dissolution tests for fuel reprocessing. The fuel tested here had a peak burnup of 0.22 at. %, with peak centerline temperatures of 1997°C. Linear dissolution rates of 0.99 to 1.57 mm/h were determined for dissolver solution and fresh acid, respectively. Insoluble residues from dissolution at 95°C ranged from 0.18 to 0.28% of the original fuel. From 2 to 37 wt % of the residue was recoverable plutonium. Dissolution at 29°C yielded residues of 0.56 to 0.64% of the original fuel. The major elements present in the HF leached residue included Ru, Mo, and Rh. The recovered cladding from the 95°C dissolution contained the equivalent of 198 mg of ^{239}Pu per 100 g of hulls, while the cladding from the 29°c experiments contained only 0.21 mg of ^{239}Pu per 100 g of hulls. 9 references, 5 figures.

45504 **(EGG-M—25883) Plate performance in liquid-liquid extraction.** Wadkins, R.P. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 12p. (CONF-840802—17). NTIS, PC A02/MF A01; GPO Dep. File Number DE84017065.

From International topical meeting on fuel reprocessing and waste management; Jackson Hole, WY, USA (26 Aug 1984).

The relative effectiveness of perforated, nozzle, and burred plates from a capacity and extraction standpoint were studied in a pulsed liquid-liquid extraction system. The experiments were conducted in a 3.8×10^{-2} m diameter column using a mixture of aluminum nitrate, nitric acid, and uranyl nitrate as the aqueous phase, and tributyl phosphate dissolved in AMSCO 125-90 W as the organic phase. The uranium was extracted from the aqueous phase to the organic phase. A standard cartridge was made for each type of plate and consisted of an assembly of plates spaced 5.08×10^{-2} m apart. Each plate had 3.2×10^{-3} m holes spaced on 6.1×10^{-3}-m centers, and contained 23% free area. 16 references, 4 figures, 1 table.

45505 **(HW—28690) Overconcentration in initial operation of uranium evaporator, 321 Building.** Sege, G. (General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation). 10 Jul 1953. Contract AC06-76RL01857. 11p. NTIS, PC A02; 3; GPO Dep. File Number DE84016686.

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In the initial uranium solution testing of the Purex prototype facility uranium evaporator, failure of the concentrator feed pump, along with other contributing circumstances discussed later, resulted in an overconcentration of the uranyl nitrate solution to the point of incipient denitration. The overconcentration was accompanied by the evolution of brown nitrogen dioxide fumes from the concentrator. Examination of the evaporator contents after the incident has led to the conclusion that a rapid rection of nitric acid with organic material may also have occurred. The pressure buildup surmised to have accompanied the nitric acid-organic reaction apparently jarred the ceramic Raschig-ring packing in the stripping tower surmounting the concentrator tubes sufficiently to chip many of them badly. Ceramic dust and chips from the Raschig rings were found mixed with the uranium-bearing concentrator residue in almost the entire concentrator pot and filling more than half of the tubes.

45506 **(MLM—3175) Selection and testing of materials for use in a flow-through liquid sampling cell for x-ray fluorescence analysis of special nuclear materials in dissolver solution.** Hudgens, C.R. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 31 Aug 1984. Contract AC04-76DP00053. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016862.

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As part of the development of an in-line wavelength dispersive x-ray fluorescence system for the assay of SNM content of dissolver tanks in nuclear-fuel-reprocessing plants, six different flow-through sample cells were tested. In a test with 30 MWD/ton dissolver solution over a 2-y period at the TRU facility, none of the sample cells failed. This report describes the selection and testing of materials considered and finally used in the construction of the six sample cells.

45507 **(ORNL/CSD/TM—213) Physics considerations involved in the use of insoluble poisons as an alternate means of ensuring subcriticality in the rotary fuel dissolver.** Bucholz, J.A. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017646.

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While the use of soluble neutron poisons coupled with mass control is sufficient to guarantee subcriticality in the rotary fuel dissolver, an alternate means of ensuring subcriticality was also investigated from a reactor physics viewpoint. The scheme proposed in this report relies on the use of 0.25-in. diam stainless-steel-clad B_4C pellets which could be mixed uniformly with the sheared fuel from the Fast Flux Test Facility (FFTF) as it is being fed to the dissolver. The calculations described herein show that an infinite system of the type just described would be safely subcritical ($k/sub\ \infty / \leq$ 0.95) at all H/Pu ratios as long as the relative volume of FFTF fuel in the dry system does not exceed 34%. The operational complexities and equipment modifications necessary to employ this method

of criticality control have not been examined. 5 references, 6 figures, 8 tables.

45508 **(RI—161) Mass transfer coefficient and interface area for mixing of liquids in centrifugal extractor. The uranyl nitrate-nitric acid-tri-n-butyl phosphate systems.** Pushlenkov, M.F.; Kuznetsov, G.I.; Shchepetil'nikov, N.N.; Filyanin, A.T. (Radievyj Inst., Leningrad (USSR)). 1982. 30p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE84702903.

Volume-transfer coefficients of uranyl nitrate and nitric acid are determined during extraction by tri-n-butyl phosphate diluted with a mixture of saturated hydrocarbons in centrifugal extractor. The interface area is determined experimentally by two independent methods: using solidification of dispersed phase or its sedimentation. Both methods give close results. Uranium and nitric acid mass-transfer coefficients are calculated with regard to the interface area.

45509 **APEX nuclear fuel cycle for production of LWR fuel and elimination of radioactive waste.** Steinberg, M.; Powell, J.R. (Brookhaven National Lab., Upton, NY). pp 111-129 of Fourth annual energy seminar. Erie, PA; Gannon University (1982). (CONF-8203126—).

From 4. annual energy seminar; Erie, PA, USA (23 Mar 1982).

An alternative new fuel cycle is proposed for the nuclear industry which eliminates the radioactive fission product waste effluent and thus avoids long-lived geological-age radioactive waste storage and supplies fissile fuel for the LWR power reactor. For all intensive purposes this fuel cycle does not have any radioactive waste effluent. In this concept fission products are allowed to contaminate the fissile Pu but Pu is not allowed to contaminate the waste. Establishment of a firm and expanding LWR economy will allow the stockpiles of nuclear weapons to be reduced by burning up the Pu in LWR burner power reactors. 6 references, 6 figures, 5 tables.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 05090045528, 45624, 45625, 45651

45510 **(DOE/ET/34014—15) Development of a burnup meter for irradiated nuclear fuel.** Chickering, R.W.; Goldstein, N.P. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.). Feb 1984. Contract AC02-79ET34014. 98p. (WCAP—10536). NTIS (US Sales Only), PC A05/MF A01; 1; GPO Dep. File Number DE84017172.

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This report describes the development of a system which measures the burnup of an irradiated fuel assembly by determining the residual neutron count rate of the fuel assembly. The burnup meter was calibrated by correlating the neutron count rate with the reference burnups of 50 fuel assemblies. The functional requirements, system design, site calibration test, data analysis, and site application considerations are discussed in depth. The primary basis for the development of the system is to take credit for the negative reactivity effect of fuel depletion in licensing storage facilities for irradiated fuel. Taking credit for burnup will allow closer packing of fuel and reduce the need to rerack spent fuel storage pools when nuclear plants implement extended burnup PWR fuel management schemes typified by 50,000 MWD/MTU region average discharge burnup and 5.0 w/o ^{235}U initial enrichment.

45511 (INIS-mf—9040, pp 239-241) **Program for the transportation of irradiated fuel.** Rao, P.K.M.; Gavin, M.E.; Nash, K.E. (Ontario Hydro, Toronto (Canada)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45512 (INIS-mf—9040, pp 235-238) **Transient multi-dimensional approach to analyse the thermal performance of pre-disposal nuclear waste management facilities.** Chan, A.M.C.; Ahluwalia, A.K.; Banerjee, S. (McMaster Univ., Hamilton, Ontario (Canada)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45513 (INIS-mf—9040, pp 242-245) **FFTF radioactive solid waste handling and transport.** Thomson, J.D. (Westinghouse Hanford Co., Richland, WA (USA)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45514 **(NUREG/CR—3921) Dry spent fuel storage test plan for final nondestructive fuel rod examination.** Olsen, C.S. (EG and G Idaho, Inc., Idaho Falls (USA)). Jul 1984. Contract AC07-76ID01570. 15p. (EGG—2328). NTIS, PC A02/MF A01 - GPO. File Number TI84017465.

A test plan for the third and final nondestructive examination of eight fuel rods used in a low-temperature, long-term, dry fuel storage program is presented. This examination is part of a long-range project to evaluate the behavior of spent fuel during dry fuel storage conditions. The objective of this project is to provide the Nuclear Regulatory Commission with the information to confirm or establish spent-fuel dry storage licensing positions for long-term, low-temperature (<523 K), spent fuel rod behavior during dry storage and for radioactive contamination arising from spallation of cladding crud. This examination consists of visual and photographic examinations, dimensional measurements, and gamma scanning of eight fuel rods. 4 figures, 5 tables.

45515 **(ORNL/NFW—83/40) Impact of transporting defense high-level waste to a geologic repository.** Joy, D.S.; Shappert, L.B.; Boyle, J.W. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84016868.

This transportation study assumes that defense high-level waste is stored in three locations (the Savannah River, Hanford, and Idaho Falls plants) and may be disposed of in (1) a commercial repository or (2) a defense-only repository, either of which could be located at one of the five candidate sites; also documented is a preliminary analysis of the costs and risks of transporting defense high-level waste from the three storage sites to the five potential candidate repository sites. 17 references, 4 figures, 27 tables.

45516 **Helium/solid powder O-ring leakage correlation experiments using a radiotracer.** Bild, R.W.; Leishcer, W.B.; Seya, M.; Weissman, S.H. (Sandia Nat'l Laboratories P.O. Box 5800 Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **46**: 154-155(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45517 **An assessment of the response of spent fuel transports to malevolent acts.** Sandoval, R.P. (Sandia Nat'l Laboratories P.O. Box 5800 Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **46**: 151-152(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45518 **Effect of waste age on spent fuel transportation: A preliminary economic analysis.** Varadarajan, R.V.; Gupta, R.; Peterson, R.W. (Battelle Memorial Inst. Project Management Division 505 King Ave. Columbus, OH 43201). *Transactions of the American Nuclear Society;* **46**: 149-150(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45519 **Coordinating the development of a TRU waste transportation system.** Gilbert, K.V.; Hurley, J.D. (Rockwell International, Rocky Flats Plant, P.O. Box 464, Golden, CO 80401). *Transactions of the American Nuclear Society;* **46**: 150-151(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45520 **The VEPCO/DOE/EPRI dry cask storage cooperative demonstration program.** McKay, H.S.; Smith, M.L. (Virginia Electric and Power Co. P.O. Box 26600 Richmond, VA 23223). *Transactions of the American Nuclear Society;* **46**: 101-102(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

0510 Marketing And Economics

REFER ALSO TO CITATION(S) 05100045528

45521 **Decision analysis applied to reprocess or not to reprocess: Quantifying the risk.** Laughon, K.O.; Goodman, E.I. (U.S. Department of Energy, Washington, DC 20545). *Transactions of the American Nuclear Society;* **46**: 119-120(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45522 **Parametric analysis of the economic incentive for an individual reactor to reprocess for recycle.** White, M.K.; Dodd, L.R. (Battelle-Pacific Northwest Laboratory, P.O. Box 999, Richland, WA 99352). *Transactions of the American Nuclear Society;* **46**: 120-121(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

0520 Waste Management

REFER ALSO TO CITATION(S) 05200045509, 45513, 45515, 45648, 45649, 45650, 45651, 45652, 45653, 45654, 45655, 45656, 45657, 45659, 45660, 45663, 45664, 45665, 46427, 46791, 46792

45523 **(AECL—7824) Surface chemistry of mineral powders. I. Rapid determination of low surface areas of mineral powders by adsorption calorimetry.** Saluja, P.P.S.; LeBlanc, J.C.; Watson, R.L.; Oscarson, D.W. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Jun 1984. 16p. AECL-Scientific Document Dist. Office, Chalk River, Ontario $2.00. File Number TI84901836.

Low surface areas of non-porous mineral and oxide powders have been determined by adsorption calorimetry to a precision of +-5%. Five standards with surface areas in the range 0.64 to 24.3 $m^2.g^{-1}$ were examined to check the internal consistency of our method. Our surface area values agree within +-10% with supplied values, obtained by the Brunauer, Emmett and Teller (BET) nitrogen adsorption technique at -196°C. The present technique is less time consuming than commercial systems and requires small sample size (< 1 g per run). Also, the technique works at 25°C, rather than at -196°C, and can be adapted for routine operation. Finally, the technique appears preferable to a relatively tedious gas-solid chromatographic method, which uses large samples (200 to 300 g), and yields values in poor agreement with BET results. 7 references, 2 figures, 1 table.

45524 **(AECL—7827) Quantitative mineralogy and preliminary pore-water chemistry of candidate buffer and backfill materials for a nuclear fuel waste disposal vault.** Quigley, R.M. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Jul 1984. 49p. AECL-Scientific Dist. Office, Chalk River, Ontario $4.00. File Number TI84901834.

The quantitative mineralogy of seven candidate buffer and backfill materials for a nuclear fuel waste disposal vault is presented. Two of the materials were coarse grained: one a blended very pure silica sand, and the other a crushed plagioclase-rich granite or granodiorite. Five materials were fine-grained soils containing abundant clay minerals. Of these, three were fairly pure, Cretaceous, ash-derived bentonites that contained up to 3% of soluble sulphates; one was a freshwater glacial clay containing 59% interlayered smectite-illite; and one was a crushed Paleozoic shale containing abundant illite and chlorite. The adsorbed cation regimes and the pore-water chemistry of the clays are discussed. 12 references, 17 figures, 10 tables.

45525 **(ANL/EES-TM—258) Radioactive waste isolation in salt: peer review of the Office of Nuclear Waste Isolation's plan to decommission and reclaim exploratory shafts and related facilities.** Fenster, D.F.; Schubert, J.P.; Zellmer, S.D.; Harrison, W.; Simpson, D.G.; Busch, J.S. (Argonne National Lab., IL (USA)). Jul 1984. Contract W-31-109-ENG-38. 31p. NTIS, PC E03/MF A01; GPO Dep. File Number DE84017434.

Includes 1 sheet of 24x reduction microfiche.

The following recommendations are made for improving the Office of Nuclear Waste Isolation's plan for decommissioning and reclaiming exploratory shafts and other facilities associated with site characterization: (1) Discuss more comprehensively the technical aspects of activities related to decommissioning and reclamation. More detailed information will help convince the staff of the US Nuclear Regulatory Commission and others that the activities as outlined in the plan are properly structured and that the stated goals can be achieved. (2) Address in considerably greater detail how the proposed activities will satisfy specific federal, state, and local laws and regulations. (3) State clearly the precise purpose of the plan, preferably at the beginning and under an appropriate heading. (4) Also under an appropriate heading and immediately after the section on purpose, describe the scope of the plan. The tasks covered by this plan and closely related tasks covered by other appropriate plans should be clearly differentiated. (5) Discuss the possible environmental effects of drilling the exploratory shaft, excavating drifts in salt, and drilling boreholes as part of site characterization. Mitigation activities should be designed to counter specific potential impacts. High priority should be given to minimizing groundwater contamination and restoring the surface to a condition consistent with the proposed land use following completion of characterization activities at sites not chosen for repository construction. (6) Define ambiguous technical terms, either in the text when first introduced or in an appended glossary.

45526 **(BMI/ONWI—200(3)) Bibliography of studies for the Salt Repository Project Office of the Civilian Radioactive Waste Management Program, April 1978-March 1984.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jun 1984. Contract AC02-83CH10140. 272p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE84017245.

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ONWI-200 is a bibliography of approved reports produced for the US Department of Energy Salt Repository Project Office of the Civilian Radioactive Waste Management Program since April 1978. This document is intended for use by the Department of Energy, state and local officials, the US Nuclear Regulatory Commission, subcontractors to the Office of Nuclear Waste Isolation, concerned citizens, and others who have need for a comprehensive listing of reports related to a nuclear waste repository in salt. This document is divided into three parts. The first two list reports in sequence by their work breakdown structure. Part 1 lists salt-specific reports, and Part 2 lists generic reports. Part 3 presents the bibliographic data for the reports in Parts 1 and 2.

45527 **(BMI/ONWI—520) High-resolution seismic reflection study, Vacherie Dome.** (Earth Technology Corp., Houston, TX (USA)). Jun 1984. Contract AC02-83CH10140. 96p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017197.

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A high-resolution seismic reflection study, consisting of recording, processing, and interpreting four seismic reflection lines, was made at Vacherie Dome, Louisiana. The presumed shape of the dome, as pictured in the geologic area characterization report by Law Engineering Testing Company in 1982, was based largely on interpretation of gravity data, constrained by a few wells and exploration-type seismic profiles. The purpose of the study was to obtain refined profiles of the dome above -914 m (-3000 ft) elevation. Additional study had been recommended by Louisiana State University in 1967 and the Office of Nuclear Waste Isolation in 1981 because the interpreted size of Vacherie Dome was based on limited seismic and gravity data. Forty-eight traces of seismic data were recorded each time shots were made to generate energy. Twelve-fold, common-depth-point data were obtained using geophone stations spaced at 15-m (50-ft) intervals with shots at 30-m (100-ft) intervals. The time-sampling interval used was 1 ms. Processing intended to enhance resolution included iterative static corrections, deconvolution before stacking, and both time- and depth-migration. The locations of the steep dome sides were inferred primarily from terminations of strong reflections (migrated) from strata near the top of the upper and lower Cretaceous sections. This interpretation agrees closely with the presumed shape from the top of the dome to about -610 m (-2000 ft) elevation, but below this on three of the profiles, this interpretation indicates a steeper salt face than the presumed shape. The area reduction at -914 m (-3000 ft) elevation is estimated to be on the order of 20 percent. 10 references, 11 figures, 4 tables.

45528 **(DOE/S—0019/1) Fund management plan.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Aug 1984. 36p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017142.

This revision of the Fund Management Plan updates the original plan published in May 1983. It is derived from and supplements the Mission Plan of the Office of Civilian Radioactive Waste Management. A major purpose in preparing this Plan is to inform the public about management of the Nuclear Waste Fund and the Interim Storage Fund. The purpose of the Interim Storage Fund is to finance the provision of the Federal interim storage capacity of up to 1900 metric tons of spent nuclear fuel. The Nuclear Waste Fund is a separate account for all revenues and expenditures related to the geological disposal and monitored retrieval storage of civilian radioactive waste.

45529 **(DOE/SR/00001—T39) Stations VZD and VZE: composition of ending inventory reports.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 10 Feb 1984. Contract AC09-76SR00001. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84013161.

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The inventory of the following materials at stations VZD and VZE is given: depleted uranium; enriched uranium; ^{242}Pu; ^{241}Am; ^{243}Am; curium; berkelium; californium; plutonium; lithium; ^{233}U, normal uranium; neptunium; ^{238}Pu; deuterium; tritium; and thorium.

45530 (INIS-mf—9040, pp 5-6) **IAEA activities in radioactive waste management.** Barabas, K. (International Atomic Energy Agency, Vienna (Austria)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45531 **(INIS-mf—9040) International conference on radioactive waste management. Conference summaries.** (Canadian Nuclear Society, Toronto, Ontario). 1982. 342p. (In English, French). (CONF-820933—Summs.). NTIS (US Sales Only), PC A15/MF A01. File Number DE84780568.

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

Papers presented at this conference survey the field of radioactive waste management. Sessions were given on engineered barriers; geoscience for fuel waste disposal; low-level and reactor wastes; public and regulatory attitudes; performance, assessment and modelling for nuclear fuel waste disposal facilities; mine/mill waste management, waste product research and processing; interim storage, transport and handling of spent fuel; and environmental health and safety.

45532 (INIS-mf—9040, pp 10-14) **European Community programs on high level waste.** Orlowski, S. (Commission of the European Communities, Brussels (Belgium)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45533 (INIS-mf—9040, pp 81-84) **Characterization of low level radioactive waste in Canada.** Buchnea, A. (MacLaren Engineers, Planners and Scientists Inc., Willowdale , Ontario (Canada)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45534 (INIS-mf—9040, pp 85-86) **Controlled air incineration of radioactive wastes at the Los Alamos National Laboratory.** Stretz, L.; Borudin, L.; Neuls, A. (Los Alamos National Lab., NM (USA)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45535 (INIS-mf—9040, pp 87-89) **Development of pyrohydrolysis for waste volume reduction.** Desjardins, C.D.; Salter, R.S. (New Brunswick Research and Productivity Council, Fredericton (Canada)); Buckley, L.P.; Burrill, K.A. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45536 (INIS-mf—9040, pp 90-93) **Influence of leachant composition on the release of Cs-137 from ion-exchange wastes immobilised in thermosetting polymer binders.** Haighton, A.P. (Central Electricity Generating Board, Manchester (UK). Scientific Services Dept.). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45537 (INIS-mf—9040, pp 94-96) **Comparing cement, plastic and bitumen immobilization for liquid and solid reactor wastes.** Buckley, L.P. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45538 (INIS-mf—9040, pp 101-103) **Leach behaviour and mechanical integrity studies of irradiated EPICOR-II waste products.** Barletta, R.E.; Swyler, K.J.; Chan, S.F.; Davis, R.E. (Brookhaven National Lab., Upton, NY (USA)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45539 (INIS-mf—9040, pp 125-126) **Low- and intermediate-level radioactive waste management in Canada.** Charlesworth, D.H. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.); Carter, L.J. (Ontario Hydro, Toronto (Canada)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45540 (INIS-mf—9040, pp 127-128) **Low level waste management program in the United States.** Levin, G.B. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45541 (INIS-mf—9040, pp 177-180) **Development of a precipitation and filtration process for radium-226 removal from uranium milling effluents.** Averill, D.W.; Schmidt, J.W. (Department of the Environment, Burlington, Ontario (Canada) Wastewater Technology Centre); Moffett, D. (Eldorado Nuclear Ltd., Ottawa, Ontario (Canada)); Webber, R.T. (Denison Mines Ltd., Elliot Lake, Ontario (Canada)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45542 (INIS-mf—9040, pp 182-183) **Ultrafiltration for radium removal from liquid streams at a uranium mill.** Mitchell, B.M. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45543 (INIS-mf—9040, pp 188-190) **Canadian R and D high-level waste products and processes.** Wikjord, A.G.; Shoesmith, D.W.; Sargent, F.P. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45544 (INIS-mf—9040, pp 199-200) **Gas-phase abatement of radioiodine.** Vikis, A.C.; Torgerson, D.F. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment); Buckley, L.P. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45545 (INIS-mf—9040, pp 216-219) **Long term storage options for Ontario Hydro's irradiated fuel.** Dalziel, B.P.; Naqvi, S.J.; Rao, P.K.M. (Ontario Hydro, Toronto (Canada)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45546 (INIS-mf—9040, pp 220-224) **MODREX - an answer to the spent nuclear fuel storage dilemma.** Baxter, B.J.; Postula, F.D. (General Atomic Co., San Diego, CA (USA)); Brooks, H.B. (Tennessee Valley Authority, Chattanooga (USA)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45547 (INIS-mf—9040, pp 225-228) **Evaluation of concrete casks for the management of irradiated fuel.** Freire-Canosa, J. (Ontario Hydro, Toronto (Canada)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45548 (INIS-mf—9040, pp 229-231) **Characterization of irradiated CANDU fuel bundles stored in concrete canisters at WNRE.** Wasywich, K.M.; Chen, J.D.; Burns, K.I.; Boase, D.G. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

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45549 (INIS-mf—9040, pp 232-234) **Tritium permeation through the cast alloy walls of a spent fuel dry cask.** Stover, D. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung); Fleisch, J. (Deutsche Gesellschaft fuer Wiederaufarbeitung von Kernbrennstoffen m.b.H. (DWK), Hannover (Germany, F.R.)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

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45550 (INIS-mf—9040, pp 263-265) **Temporary storage of low-level waste. Facility design experience.** Tosetti, R.J.; Feizollahi, F.; Howell, H.E. (Bechtel National, Inc., San Francisco, CA (USA)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

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45554 (INIS-mf—9040, pp 18-19) **Swedish radioactive waste management.** Papp, L. (Swedish Nuclear Fuel Supply Co., Stockholm. Div. KBS). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

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45555 (INIS-mf—9040, pp 20-23) **Canadian engineered barriers program.** Nuttall, K.; Cameron, D.J.; Sargent, F.P. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

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45556 (INIS-mf—9040, pp 27-30) **Design of packed particulate supported containment for irradiated fuel immobilization.** Mikasinovic, M.; Hoy, R. (Ontario Hydro, Toronto (Canada)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

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45557 (INIS-mf—9040, pp 40-43) **Development of a high integrity container for burial of special waste.** Chapman, R.L.; Holzworth, K.E.; Ayers, A.L. Jr.; Haelsig, R.T. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

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45564 (INIS-mf—9040, pp 60-61) **Influence of heat flow on drift closure during climax granite spent fuel test. Calculations and measurements.** Butkovich, T.R.; Yow, J.L. Jr.; Montan, D.N. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

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45575 (INIS-mf—9040, pp 154-158) **Role of thermomechanical modeling in the selection of a salt repository site in the USA.** Tammemagi, H.Y.; Loken, M.C.; Wagner, R.A. (RE/SPEC, Inc., Rapid City, SD (USA)); Wigley, M.R. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45576 (INIS-mf—9040, pp 159-160) **Long-term stability analysis. The Battelle geologic simulation model.** Foley, M.G.; Petrie, G.M. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45577 (INIS-mf—9040, pp 161-162) **Comparative safety analysis of the disposal of spent fuel and the other LWR wastes in hard bedrock.** Peltonen, E.K.; Vuori, S.J.V. (Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Ydinvoimatekniikan Lab.). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45578 (INIS-mf—9040, pp 163-166) **Simulations of long-term health risk from shallow-land burial of low-level radioactive wastes.** Little, C.A.; Fields, D.E. (Oak Ridge National Lab., TN (USA)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45579 (INIS-mf—9040, pp 167-168) **Overview of current uranium tailings management practice.** Chambers, D.B.; Knapp, R.A. (Senes Consultants, Willowdale, Ontario (Canada)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45580 (LBL—15500, pp 255-274) **Special projects.** Sep 1983. NTIS, PC A13/MF A01. File Number TI84003916. Contract AC03-76SF00098.

In Earth Sciences Division annual report, 1982.

Summaries are included of four special projects, each dealing with the problem of nuclear waste isolation. The issues addressed include high-level and low-level wastes. Site characterization strategies for nuclear waste disposal in basalt are presented. Field studies and laboratory investigations focus upon the problem of low-level radioactive waste disposal in relation to inactive uranium mill tailings at two sites, one in Wyoming and the other in Colorado. Thermomechanical investigations at Stripa, Sweden reveal anomalous deviations in displacement measurements from predictions based on linear deformation theory. The role of fractures in this anomalous behavior is discussed. The advisability of considering the deep unsaturated zone at the Nevada Test Site as a possible candidate for high-level waste disposal is evaluated.

45581 (MLM—3179) **Glass furnace project: October 1983-March 1984.** Armstrong, K.M.; Klingler, L.M. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 10 Sep 1984. Contract AC04-76DP00053. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016985.

A commercially available joule-heated glass furnace system is currently being evaluated at Mound as a means of processing low-level radioactive wastes typically found at light water reactor facilities. The primary concerns of the evaluation have been to determine the effectiveness of the technique relative to waste reduction, isotope immobilization, and process costs. The radioactively spiked waste treatment experiments started earlier have continued, but have been subjected to several interruptions as a result of furnace mechanical failures. This report presents isotope capture and retention data collected to date, as well as a description and evaluation of the mechanical problems. 1 reference, 2 figures, 4 tables.

45582 (NLCO—1100-Rev.5) **Feed Materials Production Center radioactive waste management plan. Revision 5.** Diehl, D.E.; Poff, T.A. (NLO, Inc., Cincinnati, OH (USA). Feed Materials Production Center). 19 Mar 1984. Contract AC05-76OR01156. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017053.

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This document presents the site waste management plan of the Feed Materials Production Center. It sets forth the site plans for controlling releases of radioactivity and ensuring the safe storage of radioactive wastes generated by past, present and future site operations. 13 figures.

45583 (NUREG/BR—0025-Vol.10-No.6) **Information report on state legislation. Vol. 10, No. 6.** McQuade, J. (Nuclear Regulatory Commission, Washington, DC (USA). Office of State Programs). 27 Jul 1984. 8p. NTIS, PC A02/MF A01 - GPO*. File Number TI84901815.

Enacted legislation, introduced legislation, and resolutions dealing with radioactive wastes are reported by state.

45584 (NUREG/CP—0052, pp 513-535) **Interactions of acidic solutions with sediments: a case study.** Peterson, S.R.; Serne, R.J.; Felmy, A.R.; Erikson, R.L.; Krupka, K.M.; Gee, G.W. (Pacific Northwest Lab., Richland, WA). May 1984. NTIS, PC A23/MF A01 - GPO $10.00. File Number TI84901252. (CONF-8308126—).

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

A methodology is presented for investigating the chemical interactions of acidic solutions with sediments. The MINTEQ geochemical computer code was used to predict solid-phase reactions that might occur when acidic solutions contact neutral sediments which, in turn, may control the concentrations of certain dissolved components. Results of X-ray diffraction analysis of laboratory samples of sediments that have been contacted with acidic uranium mill tailings solutions suggest gypsum and jarosite precipitated. These same mineralogical changes were identified in sediment samples collected from a drained uranium mill evaporation pond

(Lucky Mc mine in Wyoming) with a 10-year history of acid attack. Geochemical modeling predicted that these same phases and several amorphous solids not identifiable by X-ray diffraction should have precipitated in the contacted sediments. An equilibrium conceptual model consisting of an assemblage of minerals and amorphous solid phases was then developed to represent a sediment column through which uranium mill tailings solutions were percolated. The MINTEQ code was used to predict effluent solution concentrations resulting from the reactions of the tailings solution with the assemblage of solid phases in the conceptual model. The conceptual model successfully predicted the concentrations of several of the macro-constituents (e.g., Ca, SO_4, Al, Fe, and Mn), but was not successful in modeling the concentrations of trace elements. The lack of success in predicting the observed trace metal concentrations suggests that other mechanisms, such as adsorption, must be included in future models. The geochemical modeling methodology coupled with the laboratory and field studies should be applicable to a variety of waste disposal problems.

45585 (NUREG/CP—0052, pp 14-51) **Hydrothermal evolution of repository groundwaters in basalt.** Apps, J.A. (Lawrence Berkeley Lab., CA). May 1984. NTIS, PC A23/MF A01 - GPO* $10.00. File Number TI84901252. (CONF-8308126—).

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

Groundwaters in the near field of a radioactive waste repository in basalt will change their chemical composition in response to reactions with the basalt. These reactions will be promoted by the heat generated by the decaying waste. It is important to predict both the rate and the extent of these reactions, and the secondary minerals produced, because the alteration process controls the chemical environment affecting the corrosion of the canister, the solubility and complexation of migrating radionuclides, the reactivity of the alteration products to radionuclides sorption, and the porosity and permeability of the host rock. A comprehensive review of the literature leads to the preliminary finding that hydrothermally altering basalts in geothermal regions such as Iceland lead to a secondary mineralogy and groundwater composition similar to that expected to surround a repository. Furthermore, laboratory experiments replicating the alteration conditions approximate those observed in the field and expected in a repository. Preliminary estimates were made of the rate of hydration and devitrification of basaltic glass and the zero-order dissolution rate of basaltic materials. The rates were compared with those for rhyolitic glasses and silicate minerals. Preliminary calculations made of mixed process alteration kinetics, involving pore diffusion and surface reaction suggest that at temperatures greater than 150°C, alteration proceeds so rapidly as to become pervasive in normally fractured basalt exposed to higher temperatures in the field. 70 references.

45586 (NUREG/CP—0052, pp 53-69) **Near field chemical speciation: the reaction of uranium and thorium with Hanford basalt and elevated pH.** Perry, D.L. (Lawrence Berkeley Lab., CA). May 1984. NTIS, PC A23/MF A01 - GPO* $10.00. File Number TI84901252. (CONF-8308126—).

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

The hydrolysis of radionuclides such as thorium and uranium and their subsequent chemisorption on Hanford basalt have been studied using a variety of techniques, including x-ray photoelectron and infrared spectroscopy. Data obtained to date indicate mixed complexes of uranium and thorium to be on the basalt surface, the complexes being radionuclide oxides, hydrated oxides (hydroxides), and carbonates. These findings are discussed with respect to their importance for input for models describing speciation and dissolution processes involving nuclear waste repository materials such as Hanford basalt. 5 figures, 2 tables.

45587 (NUREG/CP—0052, pp 70-93) **Thermodynamic properties of chemical species of waste radionuclides.** Silva, R.J.; Nitsche, H. (Lawrence Berkeley Lab., CA). May 1984. NTIS, PC A23/MF A01 - GPO* $10.00. File Number TI84901252. (CONF-8308126—).

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

The object of the experimental program at Lawrence Berkeley Laboratory is to identify gaps or conflicts in thermodynamic data on the solubilities of compounds and on the formation of solution complexes of waste radionuclides needed for the reliable prediction of solution concentrations. It involves laboratory measurements necessary to (1) generate specific new data, where none exists, in order to demonstrate the importance of a particular solution species, compound or solution parameter (e.g., temperature, Eh) and to (2) resolve conflicts in existing thermodynamic data on important species or compounds. The measurement of the solubility of $AmOHCO_3$ in 0.1 M $NaClO_4$ at 25°C and 1 atmosphere pressure has been completed. From the experimental data, an average solubility product quotient, Qsp, was evaluated for the reaction, $AmOHCO_3$ (S) + $2H^+$ = Am^{3+} + HCO_3^- + H_2O. The logarithm of Qsp was calculated to be 2.74 +/- .17. Speciation calculations, using this new data plus reported data on the solubility of $Am(OH)_3$ and the hydrolysis and carbonate complexation of Am^{3+}, indicate that the presence of carbonate can have a substantial effect on the nature of compounds and solution species formed by americium in ground waters. Since actinides in a given oxidation state tend to exhibit similar chemical properties, this result should apply to other actinides in the trivalent state. Thus, the effect of carbonate on the solubilities and complexation of trivalent actinides should be included in any predictive modelling studies required for licensing. 27 references, 4 figures, 5 tables.

45588 (NUREG/CP—0052, pp 106-123) **Valence effects of sorption: laboratory control of valence state.** Meyer, R.E.; Arnold, W.D.; Case, F.I. (Oak Ridge National Lab., TN). May 1984. NTIS, PC A23/MF A01 - GPO* $10.00. File Number TI84901252. (CONF-8308126—).

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

Estimation of the rates of migration of nuclides from nuclear waste repositories required knowledge of the interaction of these nuclides with the components of the geological formations in the path of the migration. These interactions will be dependent upon the valence state and speciation of the nuclide. If the valence state is not known, then there can be little confidence in use of the data for safety analysis. An electrochemical method of valence state control was developed which makes use of a porous electrode in a flow system containing a column of the adsorbent. By use of this method and solvent extraction analyses of the valence states, a number of reactions of interest to HLW repositories were investigated. These include the reduction of Np(V) and Tc(VII) by crushed basalt and other minerals. For the reduction of Np(V) by basalt, the experiments indicate that sorption on basalt increases with pH and that most of the Np is reduced to Np(IV). The adsorbed Np(IV) is very difficult to remove from the basalt. For the experiments with Tc(VII), the results are considerably more complicated. The results of these experiments are used to assess some of the techniques and methods currently used in safety analyses of proposed HLW repositories. Perhaps the most important consideration is that predictive modeling of valence change reactions, such as the reduction of Np(V) and Tc(VII), must be used with considerable caution, and the occurrence of such reactions should be verified as best as possible with experiments using valence state control and analyses. 13 references, 3 figures, 1 table.

45589 (NUREG/CP—0052, pp 124-150) **Surface oxidization-reduction reactions in Columbia Plateau basalts.** White, A.F.; Yee, A. (Lawrence Berkeley Lab., CA). May 1984. NTIS, PC A23/MF A01 - GPO* $10.00. File Number TI84901252. (CONF-8308126—).

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

Results are presented which define principal oxidation-reduction reactions expected between ground water and iron in the Umtanum and Cohassett basalt flows of south central Washington. Data include kinetics of aqueous iron speciation, rates of O_2 uptake and nature of oxyhydroxide precipitates. Such data are important in

predicting behavior of radionuclides in basalt aquifers including determination of valence states, speciation, solubility, sorption, and coprecipitation on iron oxyhydroxide substrates and colloids. Analyses of the basalt by XPS indicates that ferrous iron is oxidized to ferric iron on the surface and that the total iron decreases as a function of pH during experimental weathering. Iron oxyhydroxide phases did not form surface coating on basalt surfaces but rather nucleated as separate plases in solution. No significant increases in Cs or Sr sorption were observed with increased weathering of the basalt. Concurrent increases in Fe(II) and decreases in Fe(III) in slightly to moderately acid solutions indicated continued oxidization of ferrous iron in the basalt. At neutral to basic pH, Fe(II) was strongly sorbed onto the basalt surface ($Kd = 6.5 \times 10^{-3}$ l x m^2) resulting in low dissolved concentrations even under anoxic conditions. The rate of O_2 uptake increased with decreasing pH. Diffusion rates (— 10^{-14} $cm^2 \times s^{-1}$), calculated using a one-dimensional analytical model, indicate grain boundary diffusion. Comparisons of Eh values calculated by Pt electrode, dissolved O_2 and Fe(II)/Fe(III) measurements showed considerable divergence, with the ferric-ferrous couple being the preferred method of estimating Eh.

45590 (NUREG/CP—0052, pp 234-296) **Analysis of factors affecting the stability of backfill materials.** Peacor, D.R.; Essene, E.J.; Lee, J.H.; Kuo, L.C. (Univ. of Michigan, Ann Arbor). May 1984. NTIS, PC A23/MF A01 - GPO* $10.00. File Number TI84901252. (CONF-8308126—).

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

Storage of high-level nuclear waste in subsurface repositories involves a backfill material as a physical/chemical barrier between the solid waste canisters and host rock. Chemical, structural, and textural changes due to hydrothermal reaction may degrade the backfill performance over the life of the repository. In order to evaluate the potential for such changes, we have: (1) carried out hydrothermal experiments on candidate backfill materials (smectite, illite, basalt) under conditions analogous to those at the repository, (2) performed a complete characterization of these materials before and after hydrothermal treatment using EMPA, XRD, SEM/EDS, and, especially, STEM/AEM techniques, and (3) reviewed and analyzed geologic systems which are analogous to the backfill systems. These serve as natural experimental systems with ages up to many tens of millions of years. The Umtanum basalt contains up to 25% of immiscible, two-phase glasses and late opal and nontronite in fractures. These materials are especially subject to solution effects and the glass may provide K to groundwater. The kinetics of the smectite to illite and illite to muscovite transitions are primarily controlled by Al/Si diffusion which is sluggish, rather than by rapid alkali ion diffusion. Thus, even though smectite (bentonite), mixed-layer illite/smectite and illite are all metastable phases transitional to muscovite plus other phases, reactions occur so slowly that these phases are retained even within a geologic time scale for temperatures of approximately 150, 200 and 300°C, respectively. A high ratio of Ca/K (perhaps supplied by solution of calcite) inhibits the transitions. If clay layers are compacted to form a continuous matrix, water may be prevented from penetrating the backfill and promoting the clay mineral transition.

45591 (NUREG/CP—0052, pp 343-374) **Radionuclide migration around uranium ore bodies in the Alligator Rivers region of the Northern Territory, Australia - analogue of radioactive waste repositories.** Airey, P.L.; Roman, D.; Golian, C.; Short, S.; Nightingale, T.; Lowson, R.T.; Davey, B.G.; Gray, D. (Lucas Heights Research Laboratories, Sutherland, Australia). May 1984. NTIS, PC A23/MF A01 - GPO $10.00. File Number TI84901252. (CONF-8308126—).

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

Appropriate geochemical analogues may be used to reduce the uncertainties in predicting the long-term transport of actinides, radium and fission products from laboratory adsorption and hydrological data. In this study the migration of uranium series nuclides within, and down-gradient of ore bodies in the Alligator Rivers uranium province of the Northern Territory of Australia is described. A mathematical framework was developed to permit calculation of the rate of leaching or deposition of uranium and radium between defined zones of the ore bodies, and the rate of loss of the nuclides due to groundwater transport and surface erosion. A detailed study was made of the distribution of uranium, thorium and radium isotopes within various minerals comprising the weathered ore assemblage. Uranium and thorium concentrate principally in the iron minerals and radium in the clay-quartz phases. Substantial disequilibria are observed, which are attributed to a combination of α-recoil and chemical effects. Evidence of the relative lability of iron phases is presented. The transport of uranium series nuclides in groundwater intersecting the deposits was investigated. Down-gradient of the Ranger One deposit, the maximum retardation factor of uranium is 250. The role of colloids in groundwater transport is being studied. Uranium is transported principally in solution. There appears to be an equilibrium between solute and articulate uranium.

45592 (NUREG/CP—0052, pp 375-415) **Dating of ground water: an evaluation of its use in the assessment of HLW repositories.** Davis, S.N.; Bentley, H.W.; Zito, R. (Univ. of Arizona, Tuscon). May 1984. NTIS, PC A23/MF A01 - GPO $10.00. File Number TI84901252. (CONF-8308126—).

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

Dating of ground water is potentially useful in the evaluation of the hydrogeologic hazards associated with proposed repositories for high-level radioactive waste in the following ways: (1) identification of areas of static ground water where regional migration of radionuclides should be minimal; (2) help with the calibration of numerical transport models; (3) estimation of water velocities; (4) help with the prediction of future natural changes in the chemistry of ground water; and (5) help with the interpretation of the Pleistocene history of a region which will have a bearing on the development of hazards not related directly to ground water. Methods judged to be most useful for dating water are hydrodynamic calculations, the use of atmospherically derived radionuclides, and the measurement of the accumulated products of the decay of certain radionuclides. Thus far, the most useful atmospherically derived radionuclide is chlorine-36 with a half-life of about 3×10^5 years. Iodine-129, with a half-life of 1.6×10^7 years, is potentially useful in dating and tracing some waters older than 5×10^6 years. Further study is needed, however.

45593 (NUREG/CR—3798) **Characterization of cement and bitumen waste forms containing simulated low-level waste incinerator ash.** Westsik, J.H. Jr. (comp.). (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 90p. (PNL—5153). NTIS, PC A05/MF A01 - GPO $4.75. File Number TI84016960.

Incinerator ash from the combustion of general trash and ion exchange resins was immobilized in cement and bitumen. Tests were conducted on the resulting waste forms to provide a data base for the acceptability of actual low-level waste forms. The testing was done in accordance with the US Nuclear Regulatory Commission Technical Position on Waste Form. Bitumen had a measured compressive strength of 130 psi and a leachability index of 13 as measured with the ANS 16.1 leach test procedure. Cement demonstrated a compressive strength of 1400 psi and a leachability index of 7. Both waste forms easily exceed the minimum compressive strength of 50 psi and leachability index of 6 specified in the Technical Position. Irradiation to 10^8 Rad and exposure to 31 thermal cycles ranging from +60° to -30°C did not significantly impact these properties. Neither waste form supported bacterial or fungal growth as measured with ASTM G21 and G22 procedures. However, there is some indication of biodegradation due to co-metabolic processes. Concentration of organic complexants in leachates of the ash, cement and bitumen were too low to significantly affect the release of radionuclides from the waste forms. Neither bitumen nor cement containing incinerator ash caused any corrosion or degradation of potential container materials including steel, polyethylene and fiberglass. However, moist ash did cause corrosion of the steel.

45594 **(NUREG/CR—3832) Uncertainties in long-term repository performance due to the effects of future geologic processes.** Sjoreen, A.L.; Kocher, D.C. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 36p. (ORNL—6049). NTIS, PC A03/MF A01 - GPO. File Number TI84015114.

This report discusses the nature of uncertainties in predicting the long-term performance of geologic repositories for the disposal of high-level radioactive wastes that result from the effects of future geologic processes. This type of uncertainty in long-term repository performance arises from uncertainties in (1) determining current rates of geologic processes at specific sites, (2) predicting process rates over long time periods in the future, and (3) predicting the effects of future geologic processes on the waste-isolation capabilities of a repository. The qualitative and judgmental nature of predictions of future geologic processes and their effects on repository performance is emphasized. However, since significant geological changes generally occur over time periods of 100,000 years or more, it should be possible to select repository sites which are sufficiently stable that geologic processes should have no significant effects on waste isolation over a period of 10,000 years. 12 references, 2 figures, 4 tables.

45595 **(ORNL/TM—9146) Site characterization techniques used at a low-level waste shallow land burial field demonstration facility.** Davis, E.C.; Boegly, W.J. Jr.; Rothschild, E.R.; Spalding, B.P.; Vaughan, N.D.; Haase, C.S.; Huff, D.D.; Lee, S.Y.; Walls, E.C.; Newbold, J.D. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 171p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE84016742.

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The Environmental Sciences Division of the Oak Ridge National Laboratory has been investigating improved shallow land burial technology for application in the humd eastern United States. As part of this effort, a field demonstration facility (Engineered Test Facility, or ETF) has been established in Solid Waste Storage Area 6 for purposes of investigatig the ability of two trench treatments (waste grouting prior to cover emplacement and waste isolation with trench liners) to prevent water-waste contact and thus minimize waste leaching. As part of the experimental plan, the ETF site has been characterized for purposes of constructing a hydrologic model. Site characterization is an extremely important component of the waste disposal site selection process; during these activities, potential problems, which might obviate the site from further consideration, may be found. This report describes the ETF site characterization program and identifies and, where appropriate, evaluates those tests that are of most value in model development. Specific areas covered include site geology, soils, and hydrology. Each of these areas is further divided into numerous subsections, making it easy for the reader to examine a single area of interest. Site characterization is a multidiscipliary endeavor with voluminous data, only portions of which are presented and analyzed here. The information in this report is similar to that which will be required of a low-level waste site developer in preparing a license application for a potential site in the humid East, (a discussion of licensing requirements is beyond its scope). Only data relevant to hydrologic model development are included, anticipating that many of these same characterization methods will be used at future disposal sites with similar water-related problems.

45596 **(SAND—83-1122) Field geochemical studies of groundwaters in Nash Draw, southeastern New Mexico.** Lambert, S.J.; Robinson, K.L. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1984. Contract AC04-76DP00789. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017186.

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Physiochemical properties of effluents from 15 pump tests in the water-producing horizons intercepted by six holes in Nash Draw east of the WIPP site in southeastern New Mexico were field-measured at intervals of a few hours. These properties were Eh, pH, specific conductance, specific gravity, bicarbonate/carbonate, chloride, divalent cations, calcium, hydrogen sulfide, and total iron. Observations were made over periods of 17 to 184 h, during which the measurements reached varying degrees of steady state, but not necessarily equilibrium. The most useful indicators of steady state were divalent cations, chloride, and in some cases Eh. Typically, bicarbonate changed significantly during a pump test, seldom reaching steady state. This observation and the drilling history have shown that, given the nongeological sources of carbon, radiocarbon results will be difficult to interpret. Heavy-metal contamination from iron pipe in a well was not purged simply by displacing a well-bore volume, but is some complex function of armor-coating of iron by corrosion. This process of armor-coating is, in turn, influenced by pump rate, instantaneous solid-to-liquid ratio, dissolved gases, and aqueous thermodynamic properties. Thus, further determinations of trace constituents associated with heavy metals must be interpreted with care in view of the iron content. Reliable sampling of pumped wells requires a long observation time; detailed documentation of procedures, apparatus, and hole history; and a commitment of human and financial resources that may be much greater than those required for conventional laboratory analyses. 13 references, 15 figures, 19 tables.

45597 **(SAND—83-7446) Conceptual operations report for a repository at the Yucca Mountain site.** (Dravo Engineers, Inc., Denver, CO (USA)). Aug 1984. Contract AC04-76DP00789. 65p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017241.

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This study develops conceptual operations scenarios for underground mining development and waste emplacement at the prospective nuclear waste repository in tuff at the Nevada Test Site. Methods and operations required for mining, transportation and material handling, maintenance and shop practice, construction, large-diameter hole drilling, and waste emplacement and storage are presented for both the horizontal and vertical emplacement methods. These methods were developed from all current information collected by the Nevada Nuclear Waste Storage Investigations project and operations data from underground mines. Underground mining and waste emplacement operations will require the following. The underground operations of the horizontal and vertical emplacement methods require approximately 188 and 548 employees, respectively. The total power consumption for the underground operations, excluding mine lighting and instrumentation, is 1815 kVA for the horizontal emplacement method (assuming a shaft-headframe material handling system is employed) and 2945 kVA for the vertical emplacement method (assuming a 20% grade ramp material handling system is employed). The amount of water required for the mining operations in both emplacement methods is approximately 38 gal/ft of drift. This does not include the water required for dust control and pilot hole drilling. Thirty-six mobile units are required for the horizontal emplacement method and 73 mobile units are required for the vertical emplacement method. 4 references, 12 tables.

45598 **(SAND—84-1003) NNWSI exploratory shaft site and construction method recommendation report.** Bertram, S.G. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1984. Contract AC04-76DP00789. 107p. NTIS, PC A06/MF A01; GPO Dep. File Number DE84017564.

This report documents the process by which alternative construction methods were evaluated and by which potential sites were screened by the Nevada Nuclear Waste Storage Investigations (NNWSI) project for the exploratory shaft at Yucca Mountain, in Nye County, Nevada. The evaluation was made by the Ad Hoc Technical Overview Contractor Committee. Our recommendations were to construct a vertical shaft using conventional mining techniques in a dry canyon known as Coyote Wash, located on the east flank of the mountain. 11 references, 10 figures, 15 tables.

45599 **(SKBF-KBS-TR—83-19) Analysis of ground water from deep boreholes in Fjaellveden.** Laurent, S. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). Mar 1983. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702932.

Groundwater from three boreholes at an investigation site in Fjaellveden has been sampled and analyzed. This is part of a larger programme of geological, geophysical and hydrogeological investigations aimed at finding a suitable site for a high level radioactive

waste repository. Four water-bearing levels in each of the boreholes FJ2 and FJ4, and two levels in borehole FJ8, have been sampled. The sampling depths range from 106 down to 562 m. Prior to sampling, the water-bearing section is isolated between packer sleeves. The water is then pumped to the surface where sensitive parameters such as redox potential, pH, sulphide and oxygen content are measured electrochemically on the flowing water in a system isolated from the air. Water, filter and gas samples are sent to several laboratories for further analysis. The present report is a presentation of the results of the ground-water analyses. The reliability of the results is discussed but there is no evaluation in relation to geology and hydrogeology. This report presents the basic results from the groundwater analyses to be further evaluated by experts in different fields.

45600 **(SKBF-KBS-TR—83-27) Radiation effects on the chemical environment in a radioactive waste repository.** Eriksson, T.; Jacobsson, A. (Swedish Nuclear Fuel Supply Co., Stockholm. Div. KBS). Jul 1983. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702933.

The radiolytic hydrogen production in compacted bentonite have been measured at two dose rates 6.1 and 0.014 rad/sec. The hydrogen production depends on the Fe^{2+} and HCO_3^- concentration in the pore water and on the dose rate. The hydrogen production at 6.1 rad/sec is in agreement with the hydrogen production calculated assuming homogeneous kinetics and Fe^{2+} and HCO_3^- concentrations of $2.2x10^{-7}$ and $6.5x10^{-5}$ mol/dm³ respectively. The amount of divalent iron in the bentonite clay accessible for scavenging of oxidative radicals was found by Moessbauer spectroscopy to be at least 0.4percent.

45601 **(SKBF-KBS-TR—83-33) Interaction of bentonite and glass with aqueous media.** Mosslehi, M; Lambrosa, A; Marinsky, J.A. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). Apr 1983. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702915.

It has been demonstrated that $Si(OH)_4$ is an important constituent of bentonite. In bentonites natural state the $Si(OH)_4$ in the bentonite is permeable to the diffusible components of the aqeous medium in contact with it. As a consequence, the pH of the medium is a sensitive function of its ionic strength. Permeability of the $Si(OH)_4$ to salt is lost, however, by pretreatment of the bentonite with dilute acid to protonate fully the $Si(OH)_4$. The pH-producing property of the $Si(OH)_4$ then is associated with its surface properties. The glasses (ABS-39 and ABS-Y Marcoule) studied in this research program also contain hydroxylated oxide as an important constituent. These materials, however, are not observed to exhibit gel-like (three-dimensional) properties prior to or after acid pretreatment. Instead they function always as a surface (two-dimensional) and are impermeable to the diffusible components of the aqueous media that come in contact with them. As a result, the pH of the medium is dependent on ionic strength only so far as it affects the counter-ion screening efficiency of the charged surface. In both systems, bentonite and glass, the pH of the medium is affected by the presence of CO_2. The lowering of medium pH by CO_2 dissolution results in the neutralization of $Si(OH)_4$ in the untreated bentonite gel phase or in the surface of the acid pretreated bentonite or glass in contact with the medium. If glass and bentonite are in contact the action of CO_2 at their interface results in both systems striving to reach different equilibria. The result is enhanced chemical reactivity at the interface. To minimize such reactivity CO_2 must be excluded from the atmosphere in contact with the solid-liquid phases.

45602 **(SKBF-KBS-TR—83-41) Analysis of groundwater from deep boreholes in Svartboberget.** Laurent, S. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). Jun 1983. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702934.

Groundwater from two boreholes in granitic rock at an investigation site in Svartboberget has been sampled and analysed. This is part of a larger program of geological, geophysical and hydrogeological investigations aimed at finding a suitable site for a high level radioactive waste repository. Four water-bearing levels in each borehole down to the deepest at about 600m were selected. Prior to sampling, the water-bearing level is isolated between packer sleeves. The water is then pumped to the surface where sensitive parameters such as redox potential, pH, sulphide and oxygen content are measured electrochemically on the flowing water in a system isolated from the air. Water, filter and gas samples are sent to several laboratories for further analysis. The present report is a presentation of the results of the groundwater analyses. The reliability of the results is discussed but there is no evaluation in relation to geology and hydrogeology. This report presents the basic results from the groundeater analyses to be further evaluated by experts in different fields.

45603 **(SKBF-KBS-TR—83-43) Final disposal of spent nuclear fuel - geological, hydrogeological and geophysical methods for site characterization.** Ahlbom, K.; Carlsson, L.; Olsson, O. (Swedish Nuclear Fuel Supply Co., Stockholm. Div. KBS). May 1983. 78p. NTIS (US Sales Only), PC A05/MF A01. File Number DE84702919.

Investigations for the siting of a final repository for high-level radioactive waste are currently being conducted in crystalline rock formations in Sweden. A repository will be located at a depth of about 500 m, and investigations are being carried out in drill holes to below that level. A standard program has been established for the site investigations, comprising a number of phases: 1. General reconnaissance for selection of study site 2. Detailed investigation on the ground surface 3. Depth investigation in drill holes 4. Evaluation and modelling 1. Includes geological and geophysical reconnaissance measurements and drilling of one deep drill hole 2. includes surface and depth investigation within an area of approximately 4-8 km². The surface investigations consist of geophysical measurements including electrical resistivity, magnetization, induced polarization and seismic measurements, and yeild informatin on the composition and fracturing of the bedrock in the superficial parts of the study sites. Mapping of the superficial parts of the bedrock are concluded with short percussion and core drillholes down to 150-250 metres in order to determine the dip and character of fracture zones and rock boundaries. 3. Comprises core drilling to vertical depths of about 600 m, core mapping geophysical well-logging and different hydraulic downhole measurements. In core mapping, the emphasis is placed on fracture characterization of the core. The geophysical logging includes three resistivity methods, natural gamma, induced polarization, spontaneous potential and temperature, salinity, pH and Eh of the drill hole fluid. The hydraulic measurements include: measurements of hydraulic conductivity by single-hole and cross-hole testing, determination of the hydraulic fracture frequency and determination of groundwater head at different levels in the bedrock.

45604 **(SKBF-KBS-TR—83-44) Final disposal of spent nuclear fuel-equipment for site characterization.** Almen, K.; Hansson, K.; Johansson, B.E.; Nilsson, G.; Andersson, O.; Wikberg, P.; Aahagen, H. (Swedish Nuclear Fuel Supply Co., Stockholm. Div. KBS). May 1983. 58p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84702920.

The suitability of a certain geological formation as a repository for the final disposal of spent nuclear fuel can be determined only after detailed investigation and analysis. The purpose of the investigations is to provide information on the geology and the hydrology and chemistry of the site concerned. The value of these data largely depends on the way in which they have been collected. The report of the findings should enable the investigating party to evaluate the function and the accuracy of the equipment with which field data have been collected for KBS 3. This report describes the geophysical equipment, the hydraulic testing equipment, the water chemistry sample extracting equipment and the core-logging equipment used. The objectives of the instrument development have been: - to obtain a high data quality. - to collect data automatically in logs and tape recorders for direct transfer to a central processing unit. - to provide back-up in order to counteract loss of data. - to make instrument more efficient.

45605 **(SKBF-KBS-TR—83-49) Dose and dose commitment calculations from groundwaterborne radio-active elements released from a repository for spent nuclear fuel.** Bergstroem, U. (Swedish Nuclear Fuel Supply Co., Stockholm. Div. KBS). May 1983. 93p. NTIS (US Sales Only), PC A05/MF A01. File Number DE84702935.

The turnover of radioactive matter entering the biosphere with groundwater has been studied with regard to exposure and doses to critical groups and populations. Two main recipients, a well and a lake, have been considered for the inflow of groundwaterborne nuclides. Mathematical models of a set of coupled ecosystems on regional, intermediate and global levels have been used for calculations of doses. The intermediate system refers to the Baltic Sea. The mathematical treatment of the model is based upon compartment theory with first order kinetics and also includes products in decay chains. The time-dependent exposures have been studied for certain long-lived nuclides of radiological interest in waste from disposed fuel. Dose and dose commitment have been calculated for different episodes for inflow to the biosphere.

45606 **(SKBF-KBS-TR—83-53) Evaluation of the geological, geophysical and hydrogeological conditions at Gideaa.** Ahlbom, K.; Albino, B.; Carlsson, L.; Nilsson, G.; Olsson, O.; Stenberg, L.; Timje, H. (Swedish Nuclear Fuel Supply Co., Stockholm. Div. KBS). May 1983. 73p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84702921.

The Gideaa study site has a flat topography, insignificant soil depth and a high percentage of outcrops. The dominating rock type in the area is veined gneiss of north-east structural strike and small dip. The fracture frequency in the rock mass is more than 4.0 fractures per metre down to a depth of 400 m. Below the 500 m level, the fracture frequency is 2.0 fractures per metre. Within the study site there are defined local fracture zones at a mutual distance of 400-800 m. These local fracture zones delimit a triangular block of rock with a top surface of 1.8 km^2. This bloc is transversed by two local fracture zones, approx 4 m wide. The fracture zones are steeply dipping with the exception of two subhorizontal fracture zones in the northern and eastern parts of the area which are dipping outwards from the study site. Horizontal fractures of vast lateral extent can be found in the upper 100-200 metres. Frequently occurring fracture minerals in the fracture zones are calcite, kaolinite, chlorite, laumontite, pyrite and the clay minerals illite and smectite. At a depth of 500 m the granite gneiss has a hydraulic conductivity of 1.5 x 10^{-10} m/s, that of the surrounding bedrock being 2 x 10^{-11} m/s. this implies anisotropic hydraulic properties in the rock mass with a higher hydraulic conductivity horizontally. In the rock mass as a whole, i.e. by forming the average of all data from both rock types, the hydraulic conductivity decreases from c. 4 x 10^{-9} m/s at 100 m depth to c. 2 x 10^{-11} m/s at a depth of 500 m. The hydraulic conductivity in the local fracture zones at Gideaa is 9 x 10^{-11} m/s at a depth of 500 m. The hydraulic conductivity in the fracture zones decreases with increaseing depth in the same way as that of the rock mass.

45607 **(SKBF-KBS-TR—83-54) Evaluation of the geological, geophysical and hydrogeological conditions at Kamlunge.** Ahlbom, K.; Albino, B.; Carlsson, L.; Danielsson, J.; Nilsson, G.; Olsson, O.; Sehlstedt, S.; Stejskal, V.; Stenberg, L. (Swedish Nuclear Fuel Supply Co., Stockholm. Div. KBS). May 1983. 68p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84702922.

The Kamlunge study site constitutes a 16 km^2 mountain plateau. The topography of the plateau is flat, the soil cover is thin, and in the western part, there is a high percentage of outcrops. The most commonly occurring rock types are gneisses and red granite (Lina granite). A rock type with granodioritic to dioritic composition also occurs. Concentrations of economically valuable minerals are so small that mining operations are not feasible in the area. The rock mass exhibits a fracture frequency of more than 4.0 fractures per metre down to a depth of 200 metres. Below 300 metres, the fracture frequency is approximately 2.0 fractures per metre. The Kamlunge study site is surrounded by regional fracture zones to the north, east and west delimiting a 16 km^2 triangular block. The regional zone to the west of the study site has a width of about 550 m. Only local fracture zones spaced 500-l 500 m. apart occur within the study site. The local fracture zones are generally steeply inclined and strike to the north-west and the north-east. At a depth of 555 m below Kamlungekoelen, a horizontal fracture zone has been encountered in 4 of the deep drill holes. This fracture zone is permeable to water but less crushed and weathered than the steeply inclined fracture zones. Moreover, horizontal fractures of large lateral extent can occur in the upper 100-200 metres. Common fracture minerals in the fracture zones are calcite, chlorite, laumontite, smectite and various types of iron oxides. The hydraulic conductivity of the rock mass decreases markedly with depth. It decreases from about 2 x 10^{-9} m/s at a depth of 100 metres to about 10^{-11} m/s at a depth of 500 metres. The hydraulic conductivity of the local fracture zones at Kamlunge is 7 x 10^{-10} m/s at a depth of 500 m. The hydraulic conductivity decreases with depth more slowly in the fracture zones than in the rock mass.

45608 **(SKBF-KBS-TR—83-55) Evaluation of the geological, geophysical and hydrogeological conditions at Svartboberget.** Ahlbom, K.; Carlsson, L.; Gentzschein, B.; Jaemtlid, A.; Olsson, O.; Tiren, S. (Swedish Nuclear Fuel Supply Co., Stockholm. Div. KBS). May 1983. 73p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84702923.

The Svartboberget study site is an elongate hill, approx 2.5 km wide and 5 km long. The depth of the Quaternary sedimentary cover is small and the percentage of exposed rock is small. The main rock type is a migmatitic paragneiss with a great amount of neosome, granite, and subordinate veins. In the northern part of the area there is a 150 m thick layer of graphitic gneiss. The fracture frequency of the rock mass is 2.6 fractures per metre and the variation with depth is insignificant. The Svartboberget study site is situated between two north-northwest orientated valleys which are defined by regional fracture zones. The thickness of these zones are from 10 to more than 250 m. They dip 30 to 40 degrees towards the south-west and can be traced over long distances. The fracture zones consist of discrete sections, locally more than 30 m thick, of highly fractured and subordinate crushed rock. The regional fracture zones delimit a rock plinth, approx 5 km^2 large, consisting of the actual hill Svartboberget. Within this plinth there are local fracture zones with a mutual distance of 100-500 m. They contain minor parts of crushed rock. Common infilling in the fracture zones are calcite, chlorite, illite and zeolite. The hydraulic conductivity in the rock mass of Svartboberget decreases with depth. At 100 m depth, the conductivity is c. 4 x 10^{-9} m/s and at 500 m c. 5 x 10^{-11} m/s. The hydraulic conductivity of the local fracture zones in Svartboberget is at 500 m depth 8 x 10^{-10} m/s. The topographic relief of the area implies that there is a high hydraulic gradient in the bedrock. This has also been confirmed by piezometric measurements where i.a. pressure differences of a 30 m water column have been registered in a drill hole.

45609 **(SKBF-KBS-TR—83-58) Neotectonics in northern Sweden - geological investigations.** Lagerbaeck, R.; Witschard, F. (Swedish Nuclear Fuel Supply Co., Stockholm. Div. KBS). May 1983. 60p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84702924.

Fairly large areas around the formerly known quaternary faults have been air photo interpreted. The fault known as the Parvie fault has been found to extend somewhat further towards the south, thereby crossing the valley of the Stora Lule river. Furthermore, another fault has been discovered in the Lansjaerv region, and thus the faults in this area form a better fit to the regional pattern, with a SSW - NNE trend and a relative uplift of the eastern part. The fault scarps have been leveled photogrammatrically, and reproduced on maps on the scales of 1:50000 and 1:100000, and on overview maps on the scale of 1:250000. The highest level scarps somewhat exceed 30 m. The total length of the faults is roughly 300 km. During the air photo interpretation, several landslides have been detected, and it seems evident from their location that there is a causal connection between faults and landslides. It seems evident that the different faults are not simultaneously formed, but created at separate events. Representative samples have been collected, and thin sections of these investigated under the microscope. Often, the bedrock shows signs of older tectonic influence, and it seems that the faults largerly have been released along existing zones of weakness in the bedrock. However, striking exceptions, with fracturing through unaltered rock, have been found in several places. The faults illustrated in the maps below undoubt-

edly represent the most important signs of late quaternary fault activity in Norrbotten east of the Caledonian mountains. The geographic, and very probably also causal connection between faults and landslides seems obvious in both Finland and Sweden. We need a satisfactory tectonic explanation for the faults. Undoubtedly, the glacial - isostatic forces have a central role. The strike of the faults is approximately perpendicular to the direction of plate motion, and compressive forces have acted at the formation of the faults.

45610 **(UCID—20165) Nevada Nuclear Waste Storage Investigations Project interim acceptance specifications for Defense Waste Processing Facility and West Valley Demonstration Project waste forms and canisterized waste.** Oversby, V.M. (Lawrence Livermore National Lab., CA (USA)). Aug 1984. Contract W-7405-ENG-48. 54p. NTIS, PC A04/MF A01; GPO Dep. File Number DE84017602.

The waste acceptance specifications presented in this document represent the first stage of the Nevada Nuclear Waste Storage Investigations Project effort to establish specifications for the acceptance of waste forms for disposal at a nuclear waste repository in Yucca Mountain tuff. The only waste forms that will be dealt with in this document are the reprocessed waste forms resulting from solidification of the Savannah River Plant defense high level waste and the West Valley high level wastes. Specifications for acceptance of spent fuel will be covered in a separate document.

45611 **(YJT—82-56) Site investigations for final disposal of high-level nuclear waste. Research program.** Aeikaes, T.; Laine, T. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Dec 1982. 70p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. File Number DE84702925.

Research concerning disposal of high-level nuclear waste of the Industrial Power Company Ltd has focused on deep underground disposal in Finnish precambrian bedrock. The present target is to have a repository for high-level waste in operation by 2020. Selection of the repository site is based on site investigations. In addition to geosciences, selection of appropriate site includes many branches of studies; engineering, safety analysis, ecology, transport, demography etc. The investigations required for site selection for high-level waste have been arranged in a sequence of four phases. The aim of the phases is that investigations become more and more detailed as the selection process continues. Phase I of the investigations is the characterization of potential areas. This comprises establishment of criteria for site selection and identification of areas that meet selection criteria. Objective of these studies is to determine areas for phase II field investigations. The studies are largely made by reviewing existing data and remote-sensing techniques. Phase II field investigations will be undertaken between 1986-1992. The number of potential candidates for repository site is reduced to few preferred areas by preceeding generic study. The site selection process culminates in phase III in site confirmation studies carried out at 2...3 most suitable sites during 1992-2010. This is then followed by phase IV, which comprises very detailed investigations at the selected site. An alternative for these investigations is to undertake them by using pilot shaft and drifts. Active development is taking place in all phases concerning investigation methods, criteria, parameters, data processing and modelling. The applicability of the various investigation methods and techniques is tested in a deep borehole in phase I. The co-operation with countries with similar geological conditions makes it possible to compare results obtained by different techniques.

45612 **(YJT—82-58) Suitability of Finnish bedrock to the final disposal of high-level radioactive waste.** Vuorela, P.; Hakkarainen, V. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Dec 1982. 72p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. File Number DE84702926.

A regional investigation of the suitability of Finnish bedrock to the final disposal of high-level radioactive waste is described. International geological criteria are applied to Finnish bedrock conditions. The main bedrock units are classified into different areas as concerning to recommendations for further site selection investigations. The Pre-Cambrian crystalline rocks are generally of tight and strong composition and a major problem from the standpoint of waste disposal is fracturing. On the other hand, fractures are quite unevenly distributed in Finland and the bedrock seems to consist of stabile blocks surrounded by fracture zones. Crustal movements between the different bedrock blocks are in Finland at most only tenths of millimeters a year, and the movements are concentrated in the fracture zones. The fracture pattern also controls the hydrogeological system of the bedrock as the main groundwater flow occurs along the fractures. The fracturing thus has an influence on the stability as well as the hydrogeological conditions of the bedrock. The regional recommendations for further site selection studies are based on geological criteria, such as fracturing, seismisity and economic resources. Other criteria, such as topography and erosion, are less significant in comparison. A number of different criteria are likely to prove significant later in more detailed local site investigation studies. The most favorable regions for more detailed investigations contain the granitic rocks of Central Finland and some of them are also to be found in northern and eastern parts of the country. Almost none of the main bedrock units can be classified as completely unsuitable for site selection investigations. Massifs large enough for the final disposal of high-level radioactive waste can be found through detailed surveys in most parts of Finland because of the heterogeneity of the bedrock.

45613 **(YJT—82-60) Sorption in typical Finnish soils and some fracture filling of bedrock.** Nikula, A. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Dec 1982. 62p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. File Number DE84702927.

The sorption of Sr, Cs, Co, Mn, Zn and Ce from groundwater to unconsolidated geological materials was determined. The samples were selected to represent typical Finnish soils of known geological properties. In addition, soil and sea bottom sediment samples were collected from nuclear power plant sites, and some fracture filling of bedrock were also taken. In each case groundwater was taken from the same sampling site. Sample characterization included determinations of dry density, porosity, soil texture, cation exchange capacity, exchangeable cations, pH and electrical conductivity. The groundwaters were characterized by determinations of pH, electrical conductivity, humus content, $KMnO^4$ consumption and concentrations of the most abundant cations and anions. Distribution coefficients of the examined nuclides were determined by a batch method, under atmospheric oxygen conditions and at the pH of the groundwater. Among examined soils the values of the distribution coefficients of the nuclides were greatest in the heavy clay. Ce, Zn and Cs were almost entirely retained by most of the soils while the lowest distribution coefficients were measured for Sr and Mn. The retention of the nuclides was higher for fracture fillings of bedrock than for tills. Sr and Mn were sorbed on fracture fillings more readily than or as well as on heavy clay. The relation between Ksub(d) values and commonly measured properties of soil and groundwater is complex. Therefore developing of general predictive regression models will meet with difficulties. Likewise extrapolation of Ksub(d) values from one area to another is valid only if the natural water chemistry and mineralogy of the soil in both areas are similar.

45614 **(YJT—84-05) Geochemistry of the ground waters of the bedrock on Haestholmen, Loviisa.** Hyyppae, J. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Mar 1984. 156p. (In Finnish). NTIS (US Sales Only), PC A08/MF A01. File Number DE84702936.

Haestholmen is an island in the Gulf of Finland about 80 km east of Helsinki and 10 km southeast of the centre of the town of Loviisa. Because of its geological location at the western margin of the Viipuri rapakivi massif its bedrock is composed of various types of rapakivi. The geochemistry of the ground waters in the Haestholmen area was studied by taking samples from seven 200-m-deep holes. Electric conductivity, contents of fluoride, lead, zinc, cadmium copper and chromium were determined in samples from different layers of ground water. The present ground-water conditions in the bedrock of Haestholmen are due to the rise of the islands at a rate of close to 30 cm in 100 years, in other words, the highest places on the island were at about sea level around 5000 years ago. The layer of fresh ground water will continue to expand laterally and vertically over the next years, when the land will rise by about 1.5 m if the climate remains more or less the same as it is at present.

45615 **History and status of nondestructive assay systems at Los Alamos National Laboratory.** Koenig, R.A.; Caldwell, J.T. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **46**: 114-115(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45616 **User-friendly database of certified packaging for radioactive materials.** Tyron-Hopko, A. (EG & G Idaho Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **46**: 172-173(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45617 **Beneficial uses of fission products krypton and xenon.** Tingey, G.L.; Rohrmann, C.A.; Wheelwright, E.J. (Battelle-Pacific Northwest Laboratory, P.O. Box 999, Richland, WA 99352). *Transactions of the American Nuclear Society;* **46**: 62-63(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45618 **System description of the low-level waste management information system.** Aquilina, C.A.; Carpenter, L.D.; Jordan, E.A. (EG & G Idaho Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **46**: 549(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45619 **Treatment of TRU waste in the process experimental pilot plant.** Tait, T.D. (EG & G Idaho Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **46**: 113-114(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45620 **Strategy for treatment of commercial TRU waste.** Ross, W.A.; Allen, R.P.; Schneider, K.J.; Swanson, J.L.; Yasutake, K.M. (Battelle-Pacific Northwest Laboratory, P.O. Box 999, Richland, WA 99352). *Transactions of the American Nuclear Society;* **46**: 116-117(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45621 **Removal of radioactive cesium from streams with a high potassium content.** Barkatt, A.; Macedo, P.B.; Penafiel, L.M.; Sousanpour, W.; Sutter, H.G. (Catholic Univ. of America Vitreous State Laboratory 620 Michigan Ave., NE Washington, DC 20064). *Transactions of the American Nuclear Society;* **46**: 167-168(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45622 **Waste experimental reduction facility description and progress report.** Logan, J.A.; Larsen, M.M. (EG & G Idaho Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **46**: 168(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45623 **An economic analysis of a fluidized-bed volume reduction system.** Kalb, P.D.; Colombo, P. (Brookhaven National Laboratory, Upton, NY 11973). *Transactions of the American Nuclear Society;* **46**: 165-166(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45624 **Dry storage experience with spent fuel and high-level and transuranic wastes.** Guenther, R.J.; Divine, J.R.; Gilbert, E.R.; Kreid, D.K.; Partain, W.L.; Slate, S.C. (Battelle-Pacific Northwest Laboratory, P.O. Box 999, Richland, WA 99352). *Transactions of the American Nuclear Society;* **46**: 138-139(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45625 **The monitored retrievable storage program: Current status.** Hall, R.J. (Battelle-Pacific Northwest Laboratory, P.O. Box 999, Richland, WA 99352). *Transactions of the American Nuclear Society;* **46**: 136(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45626 **Corrosion of grade-12 titanium in simulated rock salt brines.** Ahn, T.M.; Soo, P. (Brookhaven National Laboratory, Upton, NY 11973). *Transactions of the American Nuclear Society;* **46**: 134-135(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45627 **Time-temperature dissolution and radionuclide transport.** Chambre, P.L.; Kim, C.L.; Pigford, T.H.; Williams, W.J.; Zavoshy, S. (University of California, Berkeley, CA 94720). *Transactions of the American Nuclear Society;* **46**: 131-132(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45628 **Geochemical sensitivity analysis for HLW repository risk assessment: 1. radioelement speciation.** Erickson, K.L.; Siegel, M.D. (Sandia Nat'l Laboratories P.O. Box 5800 Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **46**: 130-131(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45629 **Application of an overall systems model to repository performance assessment.** Ludwig, S.B.; McSweeney, T.I. (Battelle Memorial Inst. Project Management Division 505 King Ave. Columbus, OH 43201). *Transactions of the American Nuclear Society;* **46**: 129-130(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45630 **Nondestructive examination equipment in the Stored Waste Examination Pilot Plant.** Smith, T.H.; Anderson, B.C.; McKinley, K.B. (EG & G Idaho Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **46**: 114(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45631 **Leaching of solidified TRU-contaminated incinerator ash.** Fuhrmann, M.; Colombo, P. (Brookhaven National Laboratory, Upton, NY 11973). *Transactions of the American Nuclear Society;* **46**: 115-116(Jun 1984). (CONF-840614—).

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45632 **Transuranic waste management program at the TMI-2.** Bixby, W.W.; Grant, P.J.; McIntosh, T.W.; Quinn, G.J.; Reilly, J.K. (U.S. Department of Energy, TMI Site Office, P.O. Box 88, Middletown, PA 17057). *Transactions of the American Nuclear Society;* **46**: 110-111(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45633 **Carolina Power & Light's licensed at-reactor dry storage demonstration program.** Kunita, R.K.; Massey, J.V. (Carolina Power and Light Company, P.O. Box 1551, Raleigh, NC 27602). *Transactions of the American Nuclear Society;* **46**: 100-101(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45634 **Utility DOE Nuclear Waste Policy Act cooperative R & D.** Daily, J.L. (U.S. Department of Energy, Washington, DC 20545). *Transactions of the American Nuclear Society;* **46**: 99-100(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45635 **Description and developmental status of a low-level combustible waste incineration facility for volume reduction at INEL.** Gillins, R.L.; Logan, J.A.; Maughan, R.Y. (EG & G Idaho, Inc., P.O. Box 88, Middletown, PA 17057). *Transactions of the American Nuclear Society;* **46**: 164-165(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45636 **A technical approach for defining HLW.** Rundle, G.E.; Chu, M.S.; Felicetti, S.A.; Ortiz, N.R. (Sandia Nat'l Laboratories P.O. Box 5800 Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **46**: 162-163(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45637 **An independent derivation of the 10CFR61 commercial LLW disposal limits.** Kennedy, W.E.; Napier, B.A. (Battelle-Pacific Northwest Laboratories, P.O. Box 999, Richland, WA 99352). *Transactions of the American Nuclear Society;* **46**: 145-146(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45638 **Decontamination and repair facility for waste processing equipment.** Osborne, B.C. (E.I. du Pont de Nemours & Co., Savannah River Plant, Aiken, SC 29808). *Transactions of the American Nuclear Society;* **46**: 788-790(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45639 **Savannah River Plant low-level waste incinerator demonstration.** Tallman, J.A. (E.I. du Pont de Nemours & Co., Savannah River Plant, Aiken, SC 29808). *Transactions of the American Nuclear Society;* **46**: 786-788(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45640 **Design features of a radioactive liquid-fed ceramic melter system.** Holton, L.K.; Berger, D.N.; Bjorklund, W.J.; Dierks, R.D. (Battelle-Pacific Northwest Laboratory, P.O. Box 999, Richland, WA 99352). *Transactions of the American Nuclear Society;* **46**: 785-786(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45641 **DWPF remote capability television and cell lighting facilities.** Heckendorn, F.M. II. (E.I. du Pont de Nemours & Co., Savannah River Plant, Aiken, SC 29808). *Transactions of the American Nuclear Society;* **46**: 784-785(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45642 **Remotely replaceable jumpers and embedded wiring for the DWPF.** Heckendorn, F.M. II. (E.I. du Pont de Nemours & Co., Savannah River Plant, Aiken, SC 29808). *Transactions of the American Nuclear Society;* **46**: 784(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45643 **Remote system for burial of high specific activity/low-level radioactive wastes.** Schmoker, D.S.; Hillstrom, D.S.; Wilson, D.W. (Pacific Nuclear Systems, 2900 George Washington Way, Richland, WA 99352). *Transactions of the American Nuclear Society;* **46**: 783-784(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45644 **Public attitudes toward siting of high-level nuclear waste respositories in the state of Washington.** Moravek, B.C.K.; Erlandson, B.C. (Rockwell Hanford Operations, P.O. Box 800, Richland, WA 99352). *Transactions of the American Nuclear Society;* **46**: 604-605(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45645 **Public attitudes in salt states toward siting high-level nuclear waste repositories.** Latham, H.C.; Keller, D.L.; Taylor, T.J. (Battelle, Office of NWTS Integration, 505 King Avenue, Columbus, OH 43201). *Transactions of the American Nuclear Society;* **46**: 600-604(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45646 **Nevada: A citizen's look at the backyard.** Vieth, D.L. (U.S. Department of Energy, Nevada Operations Office, P.O. Box 14110, Las Vegas, NV 89114). *Transactions of the American Nuclear Society;* **46**: 600(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45647 **Modelling fluid flow in fractured-porous rock masses by finite-element techniques.** Baca, R.G.; Arnett, R.C. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations); Langford, D.W. (BCS Richland, Inc., WA (USA)). *International Journal for Numerical Methods in Fluids;* **4**: No. 4, 337-348(Apr 1984). (CONF-820702—).

From 4. international symposium on finite element methods in flow problems; Tokyo, Japan (26 Jul 1982).

One of the major difficulties of modelling fluid flow processes in hard-rock geologies is the complex nature of the porosity systems. Hydraulic behaviour in these rock masses is characterized by both porous and fractured interflow zones. Traditionally, fractured-porous rocks have been modelled as an equivalent porous medium or as a system of fractures separated by impermeable blocks. A new method is proposed that unifies these two approaches for modelling fluid flow processes in fractured-porous media. The basic idea is to use a combination of isoparametric elements for the porous zones and line elements for the fractures. The coupling between the governing equations for each element type is achieved using the superposition principle. The effectiveness of the new approach is demonstrated by comparing numerical solutions with known solutions for problems of flow and solute transport in fractured porous media.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 0530045494, 45584, 45585, 45586, 45587, 45588, 45589, 45590, 45591, 45592, 45627, 45628, 45629, 45665

45648 **(ANL/ER—84-4) Analysis of potential groundwater contamination in the vicinity of the Weldon Spring Raffinate Pits site, Weldon Spring, Missouri.** Tsai, S.Y.; Peterson, J.M.; Winters, M.C.B. (Argonne National Lab., IL (USA)). Aug 1984. Contract W-31-109-ENG-38. 35p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017227.

Results of the analysis of contaminant migration beneath the raffinate pits at the Weldon Spring Raffinate Pits site indicate that during a 10,000-year time period, the maximum concentrations in the water immediately beneath the pit bottoms would be about 4600 pCi/L of radium-226 (Pit 3) and about 12,000 pCi/L of uranium-238 (Pit 1); these concentrations would occur at the centers of the pit bottoms. Based on the assumptions used in this study, the radioactive contaminants in the pits would migrate no more than 2 m (7 ft) below the pit bottoms. Because 6 to 12 m (20 to 40 ft) of silty clays underlie the raffinate pits, the radioactive contaminants would take several tens of thousands of years to reach nearby groundwater supplies. Although the results of these analyses indicate that a high degree of confinement is provided by the four raffinate pits, it should be noted that the validity of such analyses rests on the quality of the parameter values utilized. Due to a lack of current site-specific data for some physical parameters, it has been necessary to use historical and regional data for these values. The values cited are at times inconsistent and contradictory, e.g., the wide range of values indicated for the permeability of clays underlying the pits. Howèver, these were the only data available. The analysis reported herein indicates that within the limitations of the available data, use of the Raffinate Pits site for long-term management of radioactive materials such as those currently being stored in the four pits appears to be feasible. 24 references, 14 figures, 7 tables.

45649 **(DOE/NV/10162—15) Assessment of flood hazard at the radioactive waste management site in Area 5 of the Nevada Test Site.** French, R.H.; Lombardo, W.S. (Nevada Univ., Reno (USA). Water Resources Center). Jul 1984. Contract AC08-81NV10162. 201p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE84017019.

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The Radioactive Waste Management Site (RWMS) is located at the junction of major alluvial fans, to the east and west, with several smaller fans merging from the north. The conclusion is, the RWMS is likely to be hit several times during an assumed design life of 150 years by flash flood events of significant magnitude. This conclusion was arrived at by using regional peak flood equations developed by the U.S. Geological Survey and various hypotheses regarding flood processes on alluvial fans. It should be noted that the flood hazard at the RWMS is not necessarily greater than it would be for any facility of a similar size and design life located on any alluvial fan in Southern Nevada. Further, the berm on the upslope side of the RWMS may offer some protection; however, the degree of protection provided by this berm was not evaluated. Although this analysis is subject to a number of limitations, which are noted and discussed within, the conclusion is substantiated by the fact that the RWMS is located on a number of alluvial fans which were formed by erosional processes that are still active. Although protective measures for the site can be developed, the development of such mitigation plans should include not only a careful consideration of the probability that the site will be hit by a flood event, but also a careful consideration of the consequences of such a hit. This report is a focused analysis of the probability that the RWMS will be hit by a flash flood, but does not address what the consequences of such an event might be. 5 references, 19 figures, 18 tables.

45650 **(EGG/10282—2031) 1983 biotic studies of Yucca Mountain, Nevada Test Site, Nye County, Nevada.** O'Farrell, T.P.; Collins, E. (EG and G, Inc., Goleta, CA (USA). Energy Measurements Group). Apr 1984. Contract AC08-83NV10282. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017360.

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A 27.5-square-mile portion of Yucca Mountain on and adjacent to the US Department of Energy's Nevada Test Site, Nye County, Nevada, is being considered as a potential location for a national high-level radioactive waste repository. Preliminary geologic and environmental characterization studies have been supported and more extensive studies are planned. Goals of the biotic surveys were to identify species of concern, describe major floral and faunal associations, and assess possible impacts of characterization and operational activities. Floral associations observed were characteristic of either the Mojave or Transition deserts that are widely distributed in southern Nevada. Diversity, in terms of total number of perennial species represented, was higher in Transition Desert associations than in Mojave Desert associations. Canopy coverage of associations fell within the range of reported values, but tended to be more homogeneous than expected. Annual vegetation was found to be diverse only where the frequency of Bromus rubens was low. Ground cover of winter annuals, especially annual grasses, was observed to be very dense in 1983. The threat of range fires on Yucca Mountain was high because of the increased amount of dead litter and the decreased amount of bare ground. Significant variability was observed in the distribution and relative abundance of several small mammal species between 1982 and 1983. Desert tortoise were found in low densities comparable with those observed in 1982. Evidence of recent activity, which included sighting of two live tortoises, was found in five areas on Yucca Mountain. Two of these areas have a high probability of sustaining significant impacts if a repository is constructed. Regeneration of aboveground shrub parts from root crowns was observed in areas damaged in 1982 by seismic testing with Vibroseis machines. These areas, which had been cleared to bare dirt by passage of the machines, also supported lush stands of winter annuals.

45651 **(NUREG—1092) Environmental assessment for 10 CFR Part 72, Licensing requirements for the independent storage of spent fuel and high-level radioactive waste.** Schulten, C.S. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering Technology). Aug 1984. 72p. NTIS, PC A04/MF A01 - GPO* $4.50. File Number TI84901854.

The Nuclear Waste Policy Act of 1982 (NWPA) addresses the need for development of monitored retrievable storage for spent fuel and high-level radioactive waste. The Commission has examined its regulations and determined that much of existing 10 CFR Part 72 regulations can be used during initial design development for a monitored retrievable storage installation (MRS); however, changes are needed to 10 CFR Part 72 to clarify specific issues which have been raised by the NWPA. The proposed revisions to 10 CFR Part 72 establish licensing requirements for a monitored retrievable storage installation. However, unless Congress authorizes construction of an MRS promulgation of these requirements would not result in construction or operation of such an installation. The issues identified as requiring resolution by the proposed amendments are (1) establishing license criteria for the long-term storage of spent fuel and high-level radioactive waste in an MRS, (2) inclusion of license requirements for the long-term storage of spent fuel and high-level radioactive waste in an MRS under 10 CFR Part 72, and (3) elimination of the current restrictions placed on fuel cladding integrity in the present Part 72 which require the fuel cladding be protected against degradation and gross ruptures, and substitution of restrictions on radioactive releases to the environment. 2 figures, 11 tables.

45652 (NUREG/CP—0052, pp 172-203) **Ion-exchange equilibria and diffusion in engineered backfill.** Soudek, A.; Jahnke, F.M.; Radke, C.J. (Univ. of California, Berkeley). May 1984. NTIS, PC A23/MF A01 - GPO* $10.00. File Number TI84901252. (CONF-8308126—).

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

Engineered backfill can add confidence to confinement times of high-level nuclear waste stored in geologic media. This paper discusses the design and operation of a unique radial-flow diffusion cell to determine ion migration rates in backfill material under realistic repository conditions. New experimental results were reported for diffusion of CsCl in a background of NaCl into compacted ben-

tonite and bentonite/quartz mixtures. Representation of the measured diffusion rates by the traditional, homogeneous porous-medium model significantly underestimates cesium penetration distances into the backfill. Surface diffusion is suggested as an additional mechanism by which cations transport in swollen montmorillonite; the surface diffusion coefficients for cesium is determined to be approximately 10^{-7} cm²/s. An electrostatic site-binding model is developed for ion-exchange equilibria on montmorillonite clay. The effect of pH, ionic strength, and specific adsorption are evaluated and compared favorably to new, experimental exchange isotherms measured on disaggregated clay. The electrostatic site-binding model permits a prediction of the influence of backfill compaction on K/sub d/ values. We find that for strongly adsorbing cations, compactions has little effect. However, anions exhibit significant Donnan exclusion with clay compaction. 40 references, 12 figures.

45653 (NUREG/CP—0052, pp 297-325) **Speciation and transport of radionuclides in ground water.** Robertson, D.E.; Toste, A.P.; Abel, K.H.; Cowan, C.E.; Jenne, E.A.; Thomas, C.W. (Pacific Northwest Lab., Richland, WA). May 1984. NTIS, PC A23/MF A01 - GPO* $10.00. File Number TI84901252. (CONF-8308126—).

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

Studies of the chemical speciation of a number of radionuclides migrating in a slightly contaminated ground water plume are identifying the most mobile species and providing an opportunity to test and/or validate geochemical models of radionuclide transport in ground waters. Results to date have shown that most of the migrating radionuclides are present in anionic or nonionic forms. These include anionic forms of ^{55}Fe, ^{60}Co, /sup 99m/Tc, ^{106}Ru, ^{131}I, and nonionic forms of ^{63}Ni and ^{125}Sb. Strontium-70 and a small fraction of the mobile ^{60}Co are the only cationic radionuclides which have been detected moving in the ground water plume beyond 30 meters from the source. A comparison of the observed chemical forms with the predicted species calculated from modeling thermodynamic data and ground water chemical parameters has indicated a good agreement for most of the radioelements in the system, including Tc, Np, Cs, Sr, Ce, Ru, Sb, Zn, and Mn. The discrepancies between observed and calculated solutions species were noted for Fe, Co, Ni and I. Traces of Fe, Co, and Ni were observed to migrate in anionic or nonionic forms which the calculations failed to predict. These anionic/nonionic species may be organic complexes having enhanced mobility in ground waters. The radioiodine, for example, was shown to behave totally as an anion but further investigation revealed that 49-57% of this anionic iodine was organically bound. The ground water and aqueous extracts of trench sediments contain a wide variety of organic compounds, some of which could serve as complexing agents for the radionuclides. These results indicate the need for further research at a variety of field sites in defining precisely the chemical forms of the mobile radionuclide species, and in better understanding the role of dissolved organic materials in ground water transport of radionuclides.

45654 (NUREG/CP—0052, pp 326-342) **Field experiment determinations of distribution coefficients of actinide elements in alkaline lake environments.** Simpson, H.J.; Trier, R.M.; Li, Y.H.; Anderson, R.F. (Columbia Univ., Palisades, NY). May 1984. NTIS, PC A23/MF A01 - GPO $10.00. File Number TI84901252. (CONF-8308126—).

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

Radionuclide concentrations of a number of elements (Am, Pu, U, Pa, Th, Ac, Ra, Po, Pb, Cs, and Sr) have been measured in the water and sediments of a group of alkaline lakes in the western USA. These data demonstrate greatly enhanced soluble phase concentrations of elements with oxidation states of III, IV, V, and VI as the result of carbonate complexing. Dissolved concentrations of isotopes of U, Pa, and Th in a lake with pH = 10 and a total inorganic carbon concentration of 4×10^{-1} moles/l were greater than those in sea water (pH = 8, $\Sigma CO_2 = 2 \times 10^{-3}$ moles/l) by order of magnitude for ^{233}U, ^{234}U (—10^2), ^{231}Pa, ^{228}Th, ^{230}Th (—10^3) and ^{232}Th (—10^5). Concentrations of fallout /sup 239,240/Pu in the more alkaline lakes were equivalent to effective distribution coefficients of —10^3, about a factor of 10^2 lower than in most other natural lakes, rivers, estuaries and coastal marine waters. Measurements of radionuclides in natural systems are essential for assessment of the likely fate of radionuclides which may be released from high level waste repositories to ground water. Laboratory-scale experiments using tracer additions of radionuclides to mixtures of water and sediment yielded distribution coefficients which were significantly different from those derived from field measurements (10^1-10^2 lower for Po and Pu). Order of magnitude calculations from thermodynamic data of expected maximum U and Th concentrations, limited by pure phase solubilities, suggest that carbonate complexing can enhance solubility by many orders of magnitude in natural waters, even at relatively low carbonate ion concentrations.

45655 (NUREG/CP—0052, pp 416-439) **Verification and improvement of predictive algorithms for radionuclide migration.** Carnahan, C.L.; Miller, C.W.; Remer, J.S. (Lawrence Berkeley Lab., CA). May 1984. NTIS, PC A23/MF A01 - GPO $10.00. File Number TI84901252. (CONF-8308126—).

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

This research investigated the adequacy of current numerical codes in simulating geochemical interactions affecting radionuclide migration, the level of complexity required in chemical algorithms of transport models, and the validity of the constant-k/sub D/ concept in chemical transport modeling. An initial survey of the literature led to the conclusion that existing numerical codes did not encompass the full range of chemical and physical phenomena influential in radionuclide migration.

45656 (NUREG/CP—0052, pp 454-463) **Geochemical and strontium isotopic studies of Columbia River basalts.** Brookins, D.G.; Murphy, M.T.; Wollenberg, H.A.; Flexser, S. (Univ. of New Mexico, Albuquerque). May 1984. NTIS, PC A23/MF A01 - GPO $10.00. File Number TI84901252. (CONF-8308126—).

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

A rhyodacite intrudes the Wanapum basalt and is exposed in a quarry along the Hood River, Oregon. Since the rhyodacite is different geochemically from the basalt, and was intruded at a high temperature, then this site can be used to evaluate the effects of the intrusion on the basalt. The intrusive rock is a high temperature heat engine, and cooling may be by convection, conduction, or both. Contact effects of the intrusion are not pronounced in the basalt, and are restricted to minor recrystallization within one meter of the contact, and to possibly some minor fracture filling. Traverses were made from the rhyodacite into the basalt, and samples at closely spaced intervals were analyzed for K, U, Th by field and laboratory γ spectrometry and by neutron activation analysis for some 35 elements. The Sr isotopic studies indicate that the rhyodacite possesses Sr(87/86) = 0.70407 +/- 0.00008 while the intruded basalts possess Sr(87/86) = 0.7052 +/- 0.0002. Even in samples of the contact, with intermingled rhyodacite and basalt, each rock preserves its own characteristic Sr(87/86) signature, thus again attesting to the closed system conditions. The authors conclude for this natural experiment that the Wanapum basalt is not readily penetrated by elements from a high temperature, molten source. Measurements confirm the Sr(87/86) ratios for the Grande Ronde basalt, with an average of 0.7055. Analyses of fracture filling minerals, which consist of clinoptilolite, chabazite, other zeolites, minor Ca-plagioclase, and calcite, range from 0.7052 to 0.7063 and average 0.7057. These data confirm that the Sr in the fracture filling minerals has been derived from the Grande Ronde basalt, and that there is no evidence for mixing of meteoric-derived Sr with basalt Sr.

45657 (NUREG/CP—0052, pp 464-491) **Uranium, thorium and trace elements in geologic occurrences as analogues of nuclear waste repository conditions.** Wollenberg, H.A.; Brookins, D.G.; Cohen, L.H.; Flexser, S.; Abashian, M.; Murphy, M.; Williams, A.E. (Lawrence Berkeley Lab., CA). May 1984. NTIS, PC A23/MF A01 - GPO $10.00. File Number TI84901252. (CONF-8308126—).

From NRC research annual review meeting of nuclear waste management research on geochemistry of HLW disposal; Reston, VA, USA (30 Aug 1983).

Contact zones between intrusive rocks and tuff, basalt, salt and granitic rock were investigated as possible analogues of nuclear waste repository conditions. Results of detailed studies of contacts between quartz monzonite of Laramide age, intrusive into Precambrian gneiss, and a Tertiary monzonite-tuff contact zone indicate that uranium, thorium and other trace elements have not migrated significantly from the more radioactive instrusives into the country rock. Similar observations resulted from preliminary investigations of a rhyodacite dike cutting basalt of the Columbia River plateau and a kimberlitic dike cutting bedded salt of the Salina basin. This lack of radionuclide migration occurred in hydrologic and thermal conditions comparable to, or more severe than those expected in nuclear waste repository environments and over time periods of the order of concern for waste repositories. Attention is now directed to investigation of active hydrothermal systems in candidate repository rock types, and in this regard a preliminary set of samples has been obtained from a core hole intersecting basalt underlying the Newberry caldera, Oregon, where temperatures presently range from 100 to 265°C. Results of mineralogical and geochemical investigations of this core should indicate the alteration mineralogy and behavior of radioelements in conditions analogous to those in the near field of a repository in basalt.

45658 **(NUREG/CR—3782) Geologic and hydrologic research at the Western New York Nuclear Service Center, West Valley, New York. Final report, August 1982-December 1983.** Albanese, J.R.; Anderson, S.L.; Fakundiny, R.H.; Potter, S.M.; Rogers, W.B.; Whitbeck, L.F.; LaFleur, R.G.; Boothroyd, J.C.; Timson, B.S. (New York State Geological Survey, Albany (USA)). Jun 1984. 624p. NTIS, PC A99/MF A01 - GPO* $15.00. File Number TI84901956.

This report is the last in a series by the New York State Geological Survey on studies funded by the US Nuclear Regulatory Commission. The report covers five important aspects of the geology and hydrology of the Western New York Nuclear Service Center, near West Valley, New York: geomorphology, stratigraphy, sedimentology, surface water, and radionuclide analyses. We reviewed past research on these subjects and present new data obtained in the final phase of NYSGS research at the site. Also presented are up-to-date summaries of the present knowledge of geomorphology and stratigraphy. The report contains a significant bibliography of previous West Valley studies. Appendices include a report on the Fall 1983 Drilling Project and the procedures used, history and prognosis of Cattaraugus Creek and tributaries down cutting, and bar modification and landslide processes of Buttermilk Valley. 100 references, 7 figures, 7 tables.

45659 **(PNL—4432-9) Chemical species of migrating radionuclides at commercial shallow land burial sites. Quarterly progress report, May-July, 1984.** Kirby, L.J.; Rickard, W.H. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017025.

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The primary purposes of this project are to develop an understanding of chemical processes that significantly influence the migration of radionuclides at commercial low-level waste (LLW) burial sites and to evaluate ecological field sampling procedures for monitoring the performance of these sites. This project will produce information to support guidance for implementation of 10 CFR 61, particularly in the development of criteria for LLW disposal site selection, management, permanent closure, and monitoring. It will also produce information needed by the Commonwealth of Kentucky as they finalize plans to stabilize, close, and monitor the Maxey Flats site. Significant current research results are reported for the follcwing tasks: inorganic and organic radionuclide species chemical forms; subsurface migration and infiltration studies; specific radionuclide mapping at Maxey Flats and commercial shallow land burial sites; ecological monitoring at commercial shallow land burial sites; and technical program coordination for LLW research. 13 references, 4 figures, 1 table.

0540 Health And Safety

REFER ALSO TO CITATION(S) 05400045505, 45507, 45517

45660 **(DOE/OR/20722—19) Preliminary engineering evaluation of remedial action alternatives for the Middlesex Municipal Landfill, Middlesex, New Jersey.** (Bechtel National, Inc., Oak Ridge, TN (USA). Advanced Technology Div.). Aug 1984. Contract AC05-81OR20722. 116p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84017187.

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The objectives of this document are to summarize existing radiological conditions necessitating remedial action at the Middlesex Municipal Landfill (MML) site, and to describe and compare alternative courses of remedial action considered feasible at this time. This document is intended to provide the information needed to support selection of a remedial action to be implemented at the MML site. Four remedial action alternatives for the MML site were identified by Bechtel National, Inc. (BNI) and approved by DOE Oak Ridge Operations Office for evaluation in this document. They are: Alternative 1 - surveillance and monitoring; Alternative 2 - minimal action; Alternative 3 - in-situ stabilization; and Alternative 4 - decontamination and restoration. Chemical characterization of the landfill is underway to establish the presence, if any, of hazardous substances within the excavation area and to determine the safety requirements for excavation associated with Alternatives 3 and 4. For each of the above alternatives, conceptual engineering was performed, occupational health effects evaluated, and a cost estimate prepared. Costs and advantages and disadvantages of each were compared and evaluated. Table 1-1 summarizes these comparisons. 14 references, 6 figures, 9 tables.

45661 **(LA-UR—84-2479) Fire simulation in nuclear facilities: the FIRAC code and supporting experiments.** Burkett, M.W.; Martin, R.A.; Fenton, D.L.; Gunaji, M.V. (Los Alamos National Lab., NM (USA); New Mexico State Univ., Las Cruces (USA)). 1984. Contract W-7405-ENG-36. 33p. (CONF-840806—8). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016485.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

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The fire accident analysis computer code FIRAC was designed to estimate radioactive and nonradioactive source terms and predict fire-induced flows and thermal and material transport within the ventilation systems of nuclear fuel cycle facilities. FIRAC maintains its basic structure and features and has been expanded and modified to include the capabilities of the zone-type compartment fire model computer code FIRIN developed by Battelle Pacific Northwest Laboratory. The two codes have been coupled to provide an improved simulation of a fire-induced transient within a facility. The basic material transport capability of FIRAC has been retained and includes estimates of entrainment, convection, deposition, and filtration of material. The interrelated effects of filter plugging, heat transfer, gas dynamics, material transport, and fire and radioactive source terms also can be simulated. Also, a sample calculation has been performed to illustrate some of the capabilities of the code and how a typical facility is modeled with FIRAC. In addition to the analytical work being performed at Los Alamos, experiments are being conducted at the New Mexico State University to support the FIRAC computer code development and verification. This paper summarizes two areas of the experimental work that support the material transport capabiities of the code: the plugging of high-efficiency particulate air (HEPA) filters by combustion aerosols and the transport and deposition of smoke in ventilation system ductwork.

45662 **(LA-UR—84-2698) Differences in in vitro dissolution properties of settled and airborne uranium material.** Scripsick, R.C.; Crist, K.C.; Tillery, M.I.; Soderholm, S.C. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 6p. (CONF-841016—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016784.

From International conference on occupational radiation safety in mining; Toronto, Ontario, Canada (15 Oct 1984).

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The dissolution behavior of settled and airborne uranium material produced by firing of depleted uranium munitions was studied using an in vitro dissolution technique. Differences in the composition of bulk and respirable fraction samples of these materials were observed. Dissolution analysis results suggest that under some conditions a rapidly dissolving uranium fraction may be formed. This fraction may play an important role in determining hazard potential associated with inhalation exposure to uranium materials. The fact that a larger rapidly dissolving fraction was observed in the airborne material than in the settled material indicates that dissolution analysis should be performed on appropriate size fraction samples. 20 references, 3 figures, 4 tables.

45663 **Preliminary safety assessment study for NNWSI geologic repository conceptual design: Off-site releases.** Jackson, J.L.; Gram, H.F.; Hong, K.J.; Ng, H.S.; Pendergrass, A.M. (Sandia Nat'l Laboratories P.O. Box 5800 Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **46**: 160-161(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45664 **Comparison of potential health and safety impacts of different disposal options for defense HLW.** Kocher, D.C.; Smith, E.D.; Witherspoon, J.P. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **46**: 161-162(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45665 **Computation of health risk associated with radionuclide transport and human exposure.** Fields, D.E. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **46**: 15-16(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

0550 Regulations

REFER ALSO TO CITATION(S) 05500045517

45666 **(LA-UR—84-2262) Pajarito Monitor: a high-sensitivity monitoring system for highly enriched uranium.** Fehlau, P.E.; Coop, K.; Garcia, C. Jr.; Martinez, J. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 8p. (CONF-840734—17). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84015426.

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

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The Pajarito Monitor for Special Nuclear Material is a high-sensitivity gamma-ray monitoring system for detecting small quantities of highly enriched uranium transported by pedestrians or motor vehicles. The monitor consists of two components: a walk-through personnel monitor and a vehicle monitor. The personnel monitor has a plastic-scintillator detector portal, a microwave occupancy monitor, and a microprocessor control unit that measures the radiation intensity during background and monitoring periods to detect transient diversion signals. The vehicle monitor examines stationary motor vehicles while the vehicle's occupants pass through the personnel portal to exchange their badges. The vehicle monitor has four groups of large plastic scintillators that scan the vehicle from above and below. Its microprocessor control unit measures separate radiation intensities in each detector group. Vehicle occupancy is sensed by a highway traffic detection system. Each monitor's controller is responsible for detecting diversion as well as serving as a calibration and trouble-shooting aid. Diversion signals are detected by a sequential probability ratio hypothesis test that minimizes the monitoring time in the vehicle monitor and adapts itself well to variations in individual passage speed in the personnel monitor. Designed to be highly sensitive to diverted enriched uranium, the monitoring system also exhibits exceptional sensitivity for plutonium. 6 references, 9 figures, 2 tables.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

45667 **(PNL—5126) List of DOE radioisotope customers with summary of radioisotope shipments, FY 1983.** Baker, D.A. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 73p. NTIS, PC A04/MF A01; GPO Dep. File Number DE84016357.

This document lists DOE's radioisotope production and distribution activities by its facilities at Argonne National Laboratory; Pacific Northwest Laboratory; Idaho Operations Office; Los Alamos National Laboratory; Oak Ridge National Laboratory; Savannah River Plant; and UNC Nuclear Industries, Inc. The information is divided into five sections: isotope suppliers, facility contacts, and isotopes or services supplied; lists of customers, suppliers and isotopes purchased; list of isotopes purchased cross-referenced to customer codes; geographic locations of radioisotope customers; and radioisotope sales and transfers - FY 1983.

45668 **Enrichment of rare isotopes using a quadrupole mass spectrometer.** Chen, C.H.; Willis, R.D.; Hurst, G.S. (Oak Ridge National Lab., TN (USA)). *Vacuum;* **34**: No. 5, 81-584(May 1984).

A small quadrupole mass spectrometer was operated in the static mode to enrich selected rare gas isotopes. Memory effects in the apparatus were observed and attributed to the re-emission of atoms implanted by the electron-impact ion source. Studies of the pumping mechanism led to a practical means for reducing the rate of noble gas pumping.

45669 **Cyclotrons, radionuclides, precursors, and demands for routine versus research compounds.** Wolf, A.P. (Chemistry Department, Brookhaven National Laboratory, Upton, NY). *Annals of Neurology;* **15 Suppl**: S19-S24(1984).

Accelerators for producing commonly used short-lived positron emitters for positron emission tomography are addressed in the context of their use for the preparation of labeled compounds for research and routine biomedical applications. Progress and direction in the preparation and use of radiotracers for studies of the brain are discussed. Advancement to complete automation is stressed as an important factor for the eventual use of positron emission tomography as a routine clinical tool in universities and major medical centers.

0702 Radiation Sources

REFER ALSO TO CITATION(S) 07020046495

45670 (ARL/TR—060, pp 94) **Preparation of ultra-thin sources and calibration standards for coincident studies, at high resolution, of radiations emitted by the heavy elements.** Moroney, J.R.; Burns, P.A.; Johnston, P.N. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

45671 **(DOE/ET/32043—T20) Silicon Germanium (SiGe) Radioisotope Thermoelectric Generator (RTG) Program for space missions. Fifteenth technical progress report, August 1-31, 1980.** (General Electric Co., Philadelphia, PA (USA). Valley Forge Space Center). 1980. Contract AC01-79ET32043. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017623.

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This program consists of the following three tasks: Multi-Hundred Watt RTG for the Galileo Probe Mission; Reestablishment of Silicon Germanium Unicouple Capability; and General Purpose Heat Source RTG for the International Solar Polar and

Galileo Orbiter Missions. Details of program progress for each task, including a milestone schedule and a discussion of current problem areas (if any) are presented.

45672 **(INIS-mf—9034) Studies in cross-linking PVC footwear soling compounds using gamma-irradiation.** Bloom, L.I. (AECI Chlor-Alkali and Plastics Ltd., Modderfontein (South Africa)). 1983. 15p. (CONF-8311174—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE84780606.

From 7. national conference of the South African section of the Plastics and Rubber Institute; Johannesburg, South Africa (10 Nov 1983).

Irradiation cross-linking of polymeric materials has been known for some time, but it is only in recent years that it has been put to commercial advantage. Well known uses are the modification of PVC for higher temperature applications. Fundamental studies were carried out on, amongst other materials, plasticised PVC compounds for use in cable applications. The results of this work, encouraged the author to investigate cross-linkable PVC in areas such as footwear soling.

45673 **Accelerator mass spectrometry with ^{26}Al.** Middleton, R.; Klein, J. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics); Raisbeck, G.M.; Yiou, F. (Centre National de la Recherche Scientifique, 91 - Orsay (France). Lab. Rene Bernas). *Nuclear Instruments and Methods in Physics Research;* **218**: No. 1-3, 430-438(15 Dec 1983). (CONF-830570—).

From 6. international conference on ion beam analysis; Temple, AZ, USA (22 May 1983).

The cosmogenic radioisotopes ^{10}Be, ^{14}C and ^{36}Cl are routinely being measured in several laboratories but the potentially important ^{26}Al ($tau_{\frac{1}{2}} = 7.2 \times 10^5$ y) has received scant attention - largely because it is difficult to produce negative-ion beams of aluminum (particularly from the oxide) and the high abundance of ^{27}Al results in small ^{26}Al: ^{27}Al ratios (typically $<$ or approx.10^{-14} terrestrial and 10^{-10} extraterrestrial). A new ion source is described which typically generates 1 to 2 μA of $^{27}Al^-$ ions from small samples (approx.=4 mg) of Al_2O_3 with an ionization efficiency of about 0.25%. Modifications have been made to the University of Pennsylvania's FN-tandem accelerator for quantitative measurement of ^{26}Al: ^{27}Al ratios as low as 5×10^{-15} and some of the problems encountered are contrasted with those met during ^{10}Be measurements. Although measurement of ^{26}Al: ^{27}Al ratios in terrestrial samples are often close to the limit of our sensitivity, we have made measurements on a variety of terrestrial samples including stratospheric air filters, manganese nodules, tektites, and various impact glasses and on extraterrestrial samples including cosmic spherules, a meteorite and several lunar samples.

0703 Isotopic Power Supplies

45674 **(DP—66-2-6) Savannah River Laboratory isotopic power and heat sources. Monthly report, June 1966.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jun 1966. Contract AC09-76SR00001. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016870.

Declassified 7 Sep 1973.

Progress in research and development is described for the following: preparation of Tm_2O_3; properties of thulium-171; reduction of Pu-236 in Pu-238; ^{238}Pu oxide with low neutron emission; and encapsulation of cobalt-60 heat sources. (MHR)

45675 **(LA—10034-SR) General-Purpose Heat Source Development: Safety Test Program. Postimpact evaluation, Design Iteration Test 3.** Schonfeld, F.W.; George, T.G. (Los Alamos National Lab., NM (USA)). Jul 1984. Contract W-7405-ENG-36. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016977.

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The General-Purpose Heat Source(GPHS) provides power for space missions by transmitting the heat of $^{238}PuO_2$ decay to thermoelectric elements. Because of the inevitable return of certain aborted missions, the heat source must be designed and constructed to survive both re-entry and Earth impact. The Design Iteration Test (DIT) series is part of an ongoing test program. In the third test (DIT-3), a full GPHS module was impacted at 58 m/s and 930°C. The module impacted the target at an angle of 30° to the pole of the large faces. The four capsules used in DIT-3 survived impact with minimal deformation; no internal cracks other than in the regions indicated by Savannah River Plant (SRP) preimpact nondestructive testing were observed in any of the capsules. The 30° impact orientation used in DIT-3 was considerably less severe than the flat-on impact utilized in DIT-1 and DIT-2. The four capsules used in DIT-1 survived, while two of the capsules used in DIT-2 breached; a small quantity ($\approx$ 50 μg) of $^{238}PuO_2$ was released from the capsules breached in the DIT-2 impact. All of the capsules used in DIT-1 and DIT-2 were severely deformed and contained large internal cracks. Postimpact analyses of the DIT-3 test components are described, with emphasis on weld structure and the behavior of defects identified by SRP nondestructive testing.

45676 **(LA—10190-PR) Space Nuclear Safety Program. Monthly progress report, February 1984.** Bronisz, S.E. (comp.). (Los Alamos National Lab., NM (USA)). Jul 1984. Contract W-7405-ENG-36. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016973.

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Reported are: impact tests of the General-Purpose Heat Source, and impact and high-pressure seawater aging tests of the Light-Weight Radioisotope Heater Unit. (DLC)

45677 **(MMM—3824-35) SNAP-23A Program. Phase I. Thermoelectric Converter Development Program. Monthly report, April 1969.** (Minnesota Mining and Mfg. Co., St. Paul (USA). Space and Defense Products Dept.). 15 May 1969. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017118.

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The following activities were conducted during the month of April 1969: continued effort toward completion of the detailed design of the PMC-2 converter, conducted technical liaison with Westinghouse with respect to the power cable specification, conducted potting test for evaluation of material suitable for SNAP-23A converter PMC-2 leak specification, and completed design of parts for the Weld Development Program. Test data evaluation and analysis were performed on the following long-term test devices during February 1969: experimental mockup converter No. 2 (EMC-2), experimental mockup converter No. 3 (EMC-3), prototype mockup converter No. 1B (PMC-1B), 10-couple modules 1 and 3, 10-couple modules 5 through 12 on design-of-experiments tests, 6-couple module 23A3, and converter 23 P-2.

08 HYDROGEN

0801 Production

45678 **(FRNC-TH—1648) Contribution to the study of iron oxides decomposition at the focus of a solar furnace: application to a hydrogen production cycle.** Tofighi Niaki, A.A. (Toulouse-3 Univ., 31 (France)). Mar 1982. 173p. (In French). NTIS (US Sales Only), PC A08/MF A01. File Number DE84751848.

Study of the thermal decomposition of iron oxides between 1870 and 2200°K at the focus of a 2 kW solar furnace in order to determine the practicability of a thermochemical cycle for the decomposition of water in two steps: 1) $2Fe_3O_4 <-> 6FeO+O_2$; 2) $6FeO+2H_2O <-> 2Fe_3O_4+2H_2$. The experimental results are used to estimate the capacity for hydrogen production of a 1000 kW furnace (137m^3/day of hydrogen for a thermal efficiency of 25%).

45679 (SERI/CP—231-2292, pp 101-112) **Biomass electrochemistry.** Chum, H.L. Jul 1984. NTIS, PC A07/MF A01. File Number TI84013021.

In Fuel gas production from animal and agricultural residue and biomass. Contractors review meeting, December 6, 1983.

Electrochemical processing is applied to biomass and derived materials to upgrade their energy content thereby generating fuels (or additives) and to increase their reactivity and value for a variety of applications of the polymeric materials such as lignins. We are addressing the following: (1) Carboxylic acids, which can be obtained by suppressing the methane formation in anaerobic digestion processes. Our approach is to develop innovative ways of electrochemically processing dilute solutions to gaseous and/or water-insoluble fuels. (2) Lignin polymers, which are not suitable substrates for anaerobic digestion to fuels and chemicals. Our approach is to investigate relatively simple lignin-derived materials which, in principle, can be produced in large quantities and serve as models for the behavior of more complex materials. The lignin of choice is derived from an atypical and abundant hardwood such as aspen (Populus tremuloides), which has been pretreated by explosive depressurization (steam explosion) and is extracted by solvent. We aim to change the degree of polymerization of these materials and to increase their suitability as a replacement of phenol in phenol-formaldehyde thermosetting resins. In order to understand these processes in complex lignin molecules, we have synthesized lignin model compounds and are investigating their electrochemical reactions. (3) The upgrading of waste streams from biomass (terrestrial and aquatic) processing, electrochemically or photoelectrochemically. The waste streams under consideration include those from acid hydrolysis, fermentation, and alkaline treatment (e.g., kraft pulping), which contain a variety of polyfunctional carboxylic acids amenable to electrochemical processing. 15 references.

45680 **Mass transfer in parallel plate electrolyzers with two-phase liquid-liquid flow.** Lu, P.Y.; Alkire, R.C. (Department of Chemical Engineering, University of Illinois, Urbana, Illinois). *Journal of the Electrochemical Society;* **131**: No. 5, 1059-1067(May 1984).

The enhancement of mass transfer to a solid surface by addition of a dispersed immiscible second liquid phase was investigated with use of the electrochemical limiting current method. The electrolyzer consisted of a divided parallel plate cell in which electrolyte flowed upward past vertical electrodes. Three electrolytes were used: aqueous ferricyanide, aqueous ferricyanide containing inert dispersed droplets of toluene, and aqueous iodide containing dispersed toluene droplets in which was dissolved the reactant, iodine. Experiments were carried out under controlled variation of flow rate, droplet size, organic volume fraction, and electrode material. Experiments were performed both with and without use of a turbulence promoter. It was found that the overall mass-transfer rate could be separated into three elements: the single-phase mass-transfer rate; the enhancement of mass transfer owing to the physical action of dispersed liquid droplets; and the still further enhancement of mass transfer owing to the presence of reactants dissolved in the dispersed droplets. For sparingly soluble reactants, it was found that the mass-transfer enhancement achieved by extraction of reactants from a dispersed second liquid phase could be orders of magnitude larger than the other two mass-transfer mechanisms.

45681 **An electrochemical method for measurements of hydrogen and oxygen evolved in water photolysis sensitized by ZnTPP and MgTPP.** Xiao, X.R.; Ti Tien, M. (Biophysics Department, Michigan State University, East Lansing, MI). *Solar Energy;* **32**: No. 5, 567-571(1984).

The application of an electrochemical method for fast and continuous measurement of hydrogen and oxygen produced in cyclic water splitting process is described. The characteristics of this method including sensitivity, linearity and stability are discussed. Hydrogen and oxygen produced by photosensitization of ZnTPP or MgTPP in aqueous solution containing 20 per cent DMF, a variety of viologens, EDTA, either colloidal platinum, RuO_2, or PbO_2 were quantitatively detected in both gas and liquid phase. The results indicate that higher efficiency of H_2 evolution is obtained with positively charged viologen PVA^{4+}.

0802 Storage

45682 **(BNL—51174) Metallurgical studies of hydrogen storage alloys. Final report.** (International Nickel Co., Inc., Suffern, NY (USA). INCO Research and Development Center). Apr 1980. Contract AC02-76CH00016. 216p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE84017182.

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This report presents the results of an extensive experimental program designed to understand the surface poisoning of metal hydrides by impurities in the hydrogen used. Alloys investigated were $LaNi_5$, FeTi, and $Fe_{0.85}Mn_{0.15}Ti$. Gaseous impurities studied were O_2, H_2O, and CO. The nature of the surface structures formed, and consequently the degree of poisoning varies markedly from alloy to alloy and from impurity to impurity. A number of rate limiting reaction steps are apparent and examples of complex compound film formation, chemisorption, and possibly physisorption can be seen. Results show the hope of developing surface structures with significant resistance to impurity gases and especially the possibility of designing practical regeneration cycles. 25 references, 72 figures, 16 tables.

0808 Properties

45683 **(NP—4770370) Investigation of the hydrogen diffusion in the systems Nb-H, Nb-H-D and Nb-H-O by means of NMR.** Hoepfel, D. (Stuttgart Univ. (Germany, F.R.). Fakultaet 12 - Physik). 14 Jul 1982. 88p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84770370.

In the present thesis the spin-lattice relaxation of protons in the systems Nb-H-(D,O) is measured and the diffusion behaviour of hydrogen is determined. Measurements are done by nuclear magnetic resonance. In the presence of deuterium and/or oxygen the activation enthalpies are changed.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 09011046336

45684 **(ANL-BER—84-1) Biotechnology and energy. Report of a workshop on research needs, July 2, 1984.** (Argonne National Lab., IL (USA)). Aug 1984. Contract W-31-109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016281.

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A group of investigators from industry and academe, representing most of the fields that may be placed under the description biotechnology met to select, in order of priority, subject matter for workshops to be held over the next year to address research that appears to be required if biotechnology is to be used in the areas of (1) energy waste detoxification and (2) fuel and/or petrochemical synthesis. Particular focus was placed upon long-term research, which industry would not be expected to perform because of its generic nature and uncertain economic benefits.

45685 (CONF-8203178—, pp 53-61) **Application of wood-gas to combustion engines, especially to cogeneration.** Nolting, E. Jul 1982. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number TI84770366.

From 10. Salzburg economic inquiry; Salzburg, Austria (4 Mar 1982).

45686 (CONF-8203178—, pp 86-88) **Energy from waste.** Kiener, K. Jul 1982. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number TI84770366.

From 10. Salzburg economic inquiry; Salzburg, Austria (4 Mar 1982).

Brief information is given about pyrolysis, its fuels, its potential contribution to energy conservation and pollution abatement. The use of pyrolytic gases within, or in connection with cogeneration plants is recommended.

45687 (CONF-8203178—, pp 89-94) **Energy from waste and refuse.** Laistner, H. Jul 1982. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number TI84770366.

From 10. Salzburg economic inquiry; Salzburg, Austria (4 Mar 1982).

Provided that consumers sort their wastes, refuse can be converted to usable energy or material. This waste management should be carried on by little polluting, energy conservating respectively energy generating waste processing like pyrolysis. The operation of the Kiener-pyrolysis process is briefly described. A profitable operation can be achieved by using pyrolytic gases for cogeneration, when plants locating near to large quantities of consumers (30,000 - 40,000 inhabitants).

45688 **(DOE/PC/40077—T7) Liquid hydrocarbon fuels from syngas. Third annual progress report, March 1983-February 1984.** Rabo, J.A. (Union Carbide Corp., Tarrytown, NY (USA). Molecular Sieve Dept.). 1984. Contract AC22-81PC40077. 392p. NTIS, PC A17/MF A01; 1; GPO Dep. File Number DE84017230.

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Eight catalysts were tested from November, 1983 through January, 1984. One catalyst had only water gas shift activity. The other seven catalysts had Fischer-Tropsch synthesis activity from cobalt/thorium intimately mixed with either UCC-101 or UCC-103. This intimate mixture, either alone or promoted with X_4 or X_6, was then used by itself or used with other physically added shape selective and water gas shift components. The over-riding feature of these catalysts was the high degree of stability achieved from the intimate mixing of the metal component with UCC-103. The intimate mixing of the Co/Th with the UCC-101 or UCC-103 gave other characteristics to these catalysts that were not seen in their physically mixed versions. On the positive side, these intimately mixed catalysts produced liquid hydrocarbons that contained less suspended wax and had a lower olefin content. On the negative side, these intimately mixed catalysts had significantly lower water gas shift activities. The incorporation of a second shape selective component or of other ingredients to the intimately mixed Co/Th+UCC-103 constituent was even less satisfactory. It should be understood that these initial drawbacks for the intimately mixed catalysts are far less important than their achievement of obtaining good stability. Such stability was one of the major goals of this contract. Such stability was one of the major goals of this contract. Its accomplishment is a major milestone towards the development of an improved Fischer-Tropsch catalyst. Appendix B has been entered individually into EDB and ERA.

45689 (DOE/PC/40077—T7, pp 54p, Paper 1) **Surface studies. Final report.** Somorjai, G.A. (Univ. of California, Berkeley). 1984. NTIS, PC A17/MF A01. File Number TI84017230.

In Liquid hydrocarbon fuels from syngas. Third annual progress report, March 1983-February 1984.

This work covered the hydrogenation of CO on the surfaces of rhodium, rhodium compounds, promoted thorium compounds, rhenium, iron, molybdenum, and potassium-promoted molybdenum, as well as the effect of potassium on small molecular adsorbates on platinum. 28 figures.

45690 **(FRNC-TH—1653) Direct liquefaction of wood.** Kafrouni, H. (Nancy-1 Univ., 54 (France)). Oct 1982. 131p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE84751849.

An experimental study of the liquefaction of wood wastes for production of liquid products of high calorific value is described. Effects of temperature, pressure, reducing gas, particle size, solvent and reaction time are examined. Optimum efficiency is obtained at around 300°C, under an initial pressure of 15 bars of carbon monoxide with water and sodium carbonate, the oily product obtained represent 45% of the weight of wood and 65% of its energy. Liquefaction of woods, lignin and cellulose are compared.

45691 **(PNL—5096) Biomass Thermochemical Conversion Program. 1983 Annual report.** Schiefelbein, G.F.; Stevens, D.J.; Gerber, M.A. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 78p. NTIS, PC A05/MF A01; GPO Dep. File Number DE84017177.

Highlights of progress achieved in the program of thermochemical conversion of biomass into clean fuels during 1983 are summarized. Gasification research projects include: production of a medium-Btu gas without using purified oxygen at Battelle-Columbus Laboratories; high pressure (up to 500 psia) steam-oxygen gasification of biomass in a fluidized bed reactor at IGT; producing synthesis gas via catalytic gasification at PNL; indirect reactor heating methods at the Univ. of Missouri-Rolla and Texas Tech Univ.; improving the reliability, performance, and acceptability of small air-blown gasifiers at Univ. of Florida-Gainesville, Rocky Creek Farm Gasogens, and Cal Recovery Systems. Liquefaction projects include: determination of individual sequential pyrolysis mechanisms at SERI; research at SERI on a unique entrained, ablative fast pyrolysis reactor for supplying the heat fluxes required for fast pyrolysis; work at BNL on rapid pyrolysis of biomass in an atmosphere of methane to increase the yields of olefin and BTX products; research at the Georgia Inst. of Tech. on an entrained rapid pyrolysis reactor to produce higher yields of pyrolysis oil; research on an advanced concept to liquefy very concentrated biomass slurries in an integrated extruder/static mixer reactor at the Univ. of Arizona; and research at PNL on the characterization and upgrading of direct liquefaction oils including research to lower oxygen content and viscosity of the product. Combustion projects include: research on a directly fired wood combustor/gas turbine system at Aerospace Research Corp.; adaptation of Stirling engine external combustion systems to biomass fuels at United Stirling, Inc.; and theoretical modeling and experimental verification of biomass combustion behavior at JPL to increase biomass combustion efficiency and examine the effects of additives on combustion rates. 26 figures, 1 table.

45692 **(SERI/CP—231-2292) Fuel gas production from animal and agricultural residue and biomass. Contractors review meeting, December 6, 1983.** Corder, R.E. (ed.). (Solar Energy Research Inst., Golden, CO (USA)). Jul 1984. Contract AC02-83CH10093. 143p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84013021.

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This document is a compilation of reports delivered at the biannual Anaerobic Digestion contractors review meeting held December 6, 1983, at the Solar Energy Research Institute. This work was performed for the SERI Anaerobic Digestion Program with funds provided by the Biomass Energy Technology Division of the Department of Energy. Discussions were presented under the headings: Study of Methanogens by Genetic Techniques; Physiology and Biochemistry of the Interaction of Methanogenic Bacteria with Fatty Acid Producers and Utilizers; Anaerobic Digestion of Hemicellulosic Feedstocks; Biomass Electrochemistry; Continuous Culture Biomass Fermentation Studies; Autohydrolysis Pretreatment and Methane Fermentation of White Fir Slurry; and Methane from Manure-Straw Mixtures. Separate abstracts have been prepared for each presentation for inclusion in the Energy Database. (DMC)

45693 (SERI/CP—231-2292, pp 67-100) **Anaerobic digestion of hemicellulosic feedstocks.** Jul 1984. NTIS, PC A07/MF A01. File Number TI84013021.

In Fuel gas production from animal and agricultural residue and biomass. Contractors review meeting, December 6, 1983.

Previous research has shown that certain chemical and physical pretreatments can have dramatic effects on the digestibility of lignocellulosic biomass. An option being investigated under the current task involves phosphoric acid catalyzed leaching of hemicellulosic carbohydrates from biomass followed by direct anaerobic digestion of oligosaccharides and acetate to methane. Alternately, anaerobic digestion may be seen as a cost effective method of removing excess acetate and other volatile fatty acids produced in conventional fermentation. This synergistic scheme would not only

provide a further product for increased revenue, but also allow relief from the acidic condition often encountered in alcoholic fermentation. We are interested not only in the microbiological problems found in anaerobic digester design and operation, but also in the engineering studies needed to produce a meaningful flowsheet from feedstock to methane. One specific area lacking readily accessable data is that of feedstock comminution, classification and expression after hydrolysis. We have begun a program to assess the efficiency of current methodology in these areas. Discussion is presented under the headings: Comminution and Classification of Straw; Dilute Acid Hydrolysis of Straw; and Utilization of Straw Hydrolysate Through Packed Bed Anaerobic Digestion. Future Directions are presented. 4 references, 10 figures.

45694 (SERI/CP—231-2292, pp 113-127) **Continuous culture biomass fermentation studies.** Clausen, E.C.; Gaddy, J.L. (Univ. of Arkansas, Fayetteville). Jul 1984. NTIS, PC A07/MF A01. File Number TI84013021.

In Fuel gas production from animal and agricultural residue and biomass. Contractors review meeting, December 6, 1983.

The reaction kinetics of the anaerobic digestion of lignocellulosic materials to methane are quite slow. These slow reaction kinetics are reflected in high capital costs for reactors in large-scale methane facilities. This study focuses on evaluating the kinetics at increased solids feed concentrations and improving the reaction rate constant by culture enhancement and cell recycle. Improvements are measured by comparison with standard anaerobic digestion cultures. During the previous year's contract, feed concentrations up to 25 percent were fed to anaerobic digesters at a constant 60-day retention time. The kinetics of continuous cultures is limited by the microorganism concentration. Cells are continually discharged with the reactor effluent. The liquid portion of the effluent would contain a large fraction of these discharged microorganisms. Separation and recycle of the liquid fraction would substantially increase the cell population and, consequently, should enhance the reaction rate. Laboratory studies were initiated last year to determine the benefits of liquid recycle. Studies to determine the enhancement in reaction rate by adding Clostridium butyricum will be continued. A natural extension of the high solids, cell recycle, and culture enhancement studies is to operate anaerobic digestion reactors with these techniques in combination. Reactors are to be operated with high solids in combination with both cell recycle and culture enhancement. Similarly, cell recycle will be operated in combination with culture enhancement. Finally, all three techniques are to be combined in a single stirred tank reactor to measure the effect on process kinetics and economics as a function of retention time. Fundamental data from the continuous culture studies will be used to project the design and economics of commercial systems. 5 figures, 4 tables.

45695 (SERI/CP—231-2292, pp 128-134) **Autohydrolysis pretreatment and methane fermentation of white fir slurry.** McCarty, P.L.; Levy, J. (Stanford Univ., CA). Jul 1984. NTIS, PC A07/MF A01. File Number TI84013021.

In Fuel gas production from animal and agricultural residue and biomass. Contractors review meeting, December 6, 1983.

The purpose of this overall study is to evaluate the autohydrolysis pretreatment process for increasing the biodegradability of lignocellulosic materials to methane. In autohydrolysis, heat treatment results in lowered pH and subsequent hydrolysis of cellulose and hemicellulose to soluble monosaccharides which are biodegradable to methane. However, pretreatment conditions can also bring about the decomposition of monosaccharides to less biodegradable products. It was found that monosaccharide decomposition could be minimized by maintenance of pretreatment pH between 2.0 and 2.5. In the study reported here, pretreatment of a white-fir chip slurry at a pH in this range and at 200°C for one hour resulted in a product that was about 90% biodegradable. Operation of a combined pretreatment/methane fermentation system indicated that about 35% of the heat content of white fir could be converted to methane with two stages of pretreatment. This represents about 60% of the white-fir carbohydrate heat content. 2 references, 5 tables.

45696 (SERI/CP—231-2292, pp 135-139) **Methane from manure-straw mixtures.** Hashimoto, A.G. (Dept. of Agriculture, Clay Center, NE). Jul 1984. NTIS, PC A07/MF A01. File Number TI84013021.

In Fuel gas production from animal and agricultural residue and biomass. Contractors review meeting, December 6, 1983.

The objective of this effort is to develop an economically viable system to produce methane for energy from manure-crop residue mixtures. In the short term, this project will develop data on the rate and ultimate biodegradability of manure-crop residue mixtures subject to various pretreatments (including irradiation with gamma rays, NH_4OH pretreatment, and NaOH pretreatment) prior to anaerobic fermentation and will provide basic data for a pilot-scale testing program. 4 tables.

45697 **Reduction of alkynes by a new reducing system: calcium metal in amines.** Benkeser, R.A.; Belmonte, F.G. (Purdue Univ., West Lafayette, IN). *Journal of Organic Chemistry;* **49**: No. 9, 1662-1664(4 May 1984). Contract AC02-81ER10989.

The results of experiments in which a new reducing system consisting of Ca in a mixture of methylamine and ethylenediamine reacts with both terminal and internal alkenes are reported. When a 25% excess of Ca was used, no unreacted dialkylacetylenes remained in most cases. In those cases where there was unreacted dialkylacetylenes, the reaction was stopped just prior to the consumption of all the Ca. Modes of reaction for this system are proposed.

45698 **Trinuclear osmium clusters as models for intermediates in carbon monoxide reduction chemistry. 1. Stepwise reduction of CO to a μ-CH_2 ligand on an Os_3 cluster face.** Steinmetz, G.R.; Morrison, E.D.; Geoffroy, G.L. (Pennsylvania State Univ., University Park). *Journal of the American Chemical Society;* **106**: No. 9, 2559-2564(2 May 1984).

Treatment of $Os_3(CO)_{12}$ in tetrahydrofuran (THF) with $K[BH(O\text{-}i\text{-}Pr)_3]$ at 0°C gives an unstable formyl complex $K[Os_3(CO)_{11}(CHO)]$ (1). Acidification of THF solutions of 1 with aqueous 20% H_3PO_4 yields the new cluster $Os_3(CO)_{11}(\mu\text{-}CH_2)$ which has been spectroscopically characterized. Attempted alkylation of 1 with $[(CH_3)_3O]BF_4$ also gave $Os_3(CO)_{11}(\mu\text{-}CH_2)$. Methane is produced when $Os_3(CO)_{11}(\mu\text{-}CH_2)$ is heated under an H_2 atmosphere, but when the mixture is heated in the absence of H_2, CO loss occurs to yield $H_2Os_3(CO)_9(\mu_3\text{-}CCO)$, which has been spectroscopically characterized. The mechanism of the $[Os_3(CO)_{11}(CHO)]^-$ to $Os_3(CO)_{11}(\mu\text{-}CH_2)$ transformation is discussed as well as the possible relevance of these results to CO reduction on metal surfaces.

45699 **On-line analysis of Fischer-Tropsch synthesis products.** Dictor, R.A.; Bell, A.T. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory, and Department of Chemical Engineering, University of California, Berkeley, California). *Industrial and Engineering Chemistry Fundamentals;* **23**: No. Z, 252-256(May 1984).

A gas chromatographic system has been developed for the rapid, on-line analysis of products produced during Fischer-Tropsch synthesis. The system utilizes a single chromatograph fitted with two columns. A packed column containing Chromosorb 106 is used to separate C_1-C_6 hydrocarbons, low molecular weight oxygenated compounds, CO_2 and H_2O. All C_5^+ products are separated using a capillary column coated with OV-101. Complete analysis of products containing up to 32 carbon atoms can be achieved in 2.5 h.

45700 **Mixture of municipal solid waste and sewage sludge as a feedstock for biological gasification.** Chase, P.D.; Singletary, J.H. (PSE and G Research Corporation, Newark, NJ). pp 785-795 of International gas research conference. Rockville, MD, USA; Government Institutes, Inc. (1982). Contract AC01-78CS20101.

The PSE & G Research Corporation, a wholly owned subsidiary of the Public Service Electric and Gas Company (PSE & G), is participating with John G. Reutter Associates of Camden, N.J. in a study for the U.S. Department of Energy (Contract No. EM-78 -C-01-5213) entitled "Assessment of a Commercial Scale Bioconversion Demonstration Facility." A major tasking effort performed by PSE & G was a bioconversion process optimization study to examine the anaerobic digestibility of samples from several operating municipal solid waste (MSW) processing facilities. This

paper represents a report on the laboratory screening procedure utilized to determine which samples might provide the greatest methane producing potential as a possible criteria in the selection of a front-end processing system.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 09022045347, 45684, 46108

45701 (CONF-830847—8) Neutral solvents for fuel augmentation. Compere, A.L.; Griffith, W.L. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016571.

From Energy resource management '83; San Francisco, CA, USA (23 Aug 1983).

Neutral solvents are mixtures of 1-butanol, 2-propanol, acetone, and ethanol produced by bacterial fermentation of carbohydrates. Distillation schemes for neutral solvents and ethanol, and yeast and bacterial solvent fermentations are compared. The range of bacterial fermentations and feedstocks are discussed, as are modifications of the fermentations. Uses of neutral solvents and its fractions for diesel fuel and gasoline extension are discussed. (DLC)

45702 (GAO/RCED—84-1) Importance and impact of federal alcohol fuel tax incentives. (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 6 Jun 1984. 79p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901892.

With these incentives, the industry increased production tenfold between 1979 and 1982. The net impact of the incentives on the overall economy has been small. Specifically, total economic activity, employment, and the nation's trade balance have not been significantly affected by ethanol production. The net impact on the federal budget is not large. The budgetary cost of the subsidy is at least partially offset by savings in agricultural price support programs due to the added demand for corn for ethanol production. Finally, ethanol production has marginally enhanced national energy security by displacing small quantities of imported oil. Balancing the incentives' costs and benefits, GAO believes that sufficient justification exists to continue the incentives until their current scheduled 1992 expiration date.

45703 (NP—4770368) Vapour pressure studies on methanolic solutions of weakly associated electrolytes. Neueder, R. (Regensburg Univ. (Germany, F.R.). Naturwissenschaftliche Fakultaet 4 - Chemie und Pharmazie). 7 Dec 1982. 149p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84770368.

In this dissertation the construction and action of an vapour pressure measuring rig for electrolytic solutions is described. Measurements carried out on methanolic solutions of alkali halides and Bu_4NI confirm the precision of the rig and the universal applicability of this measuring method for the determination of thermodynamic properties of non-aqueous electrolytic solutions. The association constants determined from these vapour pressure measurements are in good agreement with results optained via conductivity measurement. This demonstrates that the adopted model (association limit, potential of the force mean value) well describes both thermodynamic parameters and transport properties. Expansion of the theory, and thereby the valid concentration range, could mean for example that conductivity measurement alone would be sufficient to predict lowering of vapour pressure.

45704 (SERI/TP—231-2326) Perspectives on the SERI alcohol fuels program. Douglas, L.J. (Solar Energy Research Inst., Golden, CO (USA)). May 1984. Contract AC02-83CH10093. 8p. (CONF-840804—43). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84004505.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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The production of alcohols from lignocellulosic biomass has moved from a long-range technology a few years ago to one with a real near-term potential for commercial development. SERI's 1 ton/day gasifier produces a medium-Btu gas used to make methanol with only a small water shift. Recent catalyst research has produced materials that make methanol and mixtures of higher alcohols that will enhance the value of methanol as a fuel extender. Three processes have emerged as candidates for early development. They are (1) a high-temperature, dilute-acid, plug-flow approach similar to the Dartmouth reactor; (2) steam explosion pretreatment followed by hydrolysis using the RUT-C30 fungal organism; and (3) direct microbial conversion of cellulose to ethanol using bacteria in single or mixed cultures.

45705 Selective homologation of methanol catalyzed by transition metal complexes in methanol-amine solutions. Chen, M.J.; Feder, H.M.; Rathke, J.W. (Argonne National Lab., IL). *Journal of Molecular Catalysis;* 17: 331-337(1982).

Transition metal complexes of Mn, Rh, and Ru have been found to catalyze the homologation of methanol in methanol-amine solutions at syn-gas pressures near 300 atm and temperatures near 200°C. These catalysts are believed to operate by mechanisms similar to that proposed for $Fe(CO)_5$, and likewise produce CO_2 as the oxygenated by-product and do not homologate the ethanol product. The use of two metal complexes together as catalysts has also been examined. In a mixed $Fe(CO)_5$- $Mn_2(CO)_{10}$ catalyst solution, methanol is converted at a rate of 14% H^{-1} at 220°C. Ethanol accounts for 72% of the product, the balance being methane. Additives such as phosphines and methyl iodide are found to affect the rate and the selectivity of these systems. 14 references, 3 tables.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 09040045691, 45716

45706 (NYSERDA—84-15) Advanced wood heating technologies. Final report. Shelton, J.W. (Shelton Energy Research, Santa Fe, NM (USA)). Aug 1984. 152p. Dept. of Communications, New York State Energy Research & Development Authority, Two Rockefeller Plaza, Albany, NY 12223. File Number TI84901958.

The residents of the State of New York make heavy use of wood fuel for residential heating. Many advanced technology wood heaters have been introduced recently, accompanied by impressive performance claims relating to increased energy efficiency, decreased creosote accumulation, and decreased emissions. These are important claims, since they translate into fuel conservation, increased safety through fewer chimney fires, and cleaner air. The focus of this project was to test and compare six advanced technology heaters and add-on devices, along with two reference conventional stoves, for energy efficiency, creosote accumulation, and emissions. The appliances were selected, with the assistance of a panel of experts, for their anticipated technical performance and potential market penetration in New York State. The wood heaters and add-on devices based on catalytic combustors performed especially well. Compared to the reference closed stove, the better catalytic stoves consumed up to about 40% less wood to produce the same amount of useful heat, and resulted in about 90% less creosote accumulation and about 70% to 90% less emissions. Equally impressive was the fact that these systems performed very well at all burn rates, including very low burn rates. The catalytic add-on devices exhibited lesser but still significantly improved performance. This project also included tests of some operator variables, efficiency testing methods, and some catalytic combustor design variables. 17 figures, 13 tables.

45707 (SERI/TP—215-2220) Fuelwood procurement for an industrial power plant: a case study of Dow Corning's program. Folger, A.G.; Sworden, P.G.; Bond, C.T. (Solar Energy Research Inst., Golden, CO (USA); Dow Corning Corp., Midland, MI (USA)). Aug 1984. Contract AC02-83CH10093. 9p. (CONF-830960—2; CONF-8408102—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE84013030.

From Industrial wood energy forum '83; Nashville, TN, USA (19 Sep 1983).

Dow Corning Corporation has developed effective procedures for meeting the fuelwood requirements of a 22.4 megawatt steam and electricity cogenerating power plant. The fuelwood procurement program of Dow Corning's Natural Resources Department involves special arrangements with private landowners, logging and hauling producers, and waste wood suppliers. The program's success is attributable to a favorable location, adequate allowance for advance planning, effective public relations, and flexible management. The program is significant because it demonstrates that industrial fuelwood requirements can be met and that improved production from nonindustrial private forests can be relied upon as a major source of fuelwood. 7 references, 7 figures.

0905 Liquid Waste Fuels

REFER ALSO TO CITATION(S) 09050045363

13 HYDRO ENERGY

REFER ALSO TO CITATION(S) 13000046103

1301 Resources And Availability

45708 **(DOE/R5/10275—T1) Ohio Hydropower Potential Inventory Phase I report.** (Ayres, Lewis, Norris and May, Inc., Ann Arbor, MI (USA)). Dec 1981. Contract FG45-81R510275. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84016277.

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The dams researched in the Ohio Department of Natural Resources (ODNR) files were those contained in a list of Ohio dams provided by the ODNR. The result of this file research is a list of 997 dams contained herein that tabulates information on hydraulic head, stream flow, drainage area, and usage. This listing indicated that all but 137 of the 997 dams can be eliminated from consideration for Phase II research. The second phase would be required to further identify which of the 137 dams might have viable hydroelectric potential and define their basic hydroelectric parameters.

1303 Plant Design And Operation

45709 **(DOE/RA/12117—4) Upper Mechanicville hydroelectric redevelopment demonstration project. Final technical and construction cost report.** (Acres American, Inc., Buffalo, NY; New York State Electric and Gas Corp., Binghamton (USA)). Apr 1984. Contract FC07-80ID12117. 187p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE84016962.

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The new powerhouse and intake were designed for installation of two conventional vertical-shaft, adjustable blade propeller (Kaplan) turbines, each driving an 8.4-MW synchronous generator. The plant design flow is 12,000 ft^3/s and the rated net head for the turbines is 19 ft. The turbine runner diameter is 216.5 inches (5500 mm) and the unit spacing is 61 ft. The physical dimensions of the units and associated water passages are comparable to those in much larger facilities. It must be realized, therefore, that the main features which qualify this facility as small hydro are the relatively low head and capacity. Design and construction of projects similar to Upper Mechanicville present challenges which are markedly different in scope than most small or mini hydroelectric facilities. The information in this report is presented in the following sections: historical; project management and scheduling; licensing; engineering studies; final design; construction; and project costs.

1306 Environmental Aspects

45710 **(DOE/BP—266) Methods for valuation of environmental costs and benefits of hydroelectric facilities: a case study of the Sultan River Project. Final report.** (BioSystems Analysis, Inc., Sausalito, CA (USA)). 5 Jun 1984. Contract FC79-83BP11189. 161p. NTIS, PC A08/MF A01. File Number DE84016651.

The Bonneville Power Administration is required by the Pacific Northwest Electric Power Planning and Conservation Act (Public Law 96-501) to include quantifiable environmental costs and benefits of alternative electric power resources in determining their cost-effectiveness. In responding to this requirement, BPA has contracted to develop and test methodologies for valuing environmental costs of various types of power resources, including hydroelectric facilities. The purpose of this study is to develop and test valuation methods for hydroelectric facilities, using the Sultan River Project as a case study. The case study approach offers several advantages and some disadvantages which should be considered in interpreting this report. Its primary advantage lies in providing a real-world example against which to test theoretical valuation approaches. Using data that were actually collected for a project that has received detailed scrutiny from its sponsor and from numerous regulatory agencies allows more realistic formulation of valuation issues and also provides a better test of the practicality and usefulness of valuation methods. On the other hand, results derived from such an approach must be used with discretion. First and most obvious, both the features of a hydroproject and its environmental impacts may vary widely from site to site. Second, it cannot be assumed that the results of these test exercises for the Sultan River Project represent any kind of generic hydroelectric environmental cost. A third caution is directed to those who may be tempted to regard this report as a definitive estimate of the environmental costs of the Sultan River Project. It is not. A fourth important point is only external or residual environmental costs are developed in this report. Finally, it should be noted that these methodologies were developed to meet the needs of BPA's process for determining resource cost-effectiveness.

45711 **(FERC/DEIA—0001) Draft environmental impact analysis of small-scale hydroelectric development in selected watersheds in the upper San Joaquin River Basin, California, FERC No. 5248-999.** (USDOE Federal Energy Regulatory Commission, Washington, DC. Office of Hydropower Licensing). Aug 1984. 253p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE84015549.

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Twelve unconstructed hydroelectric projects on ten sites located on Sand and Browns Creeks, Whisky Creek, Willow Creek, Jose and Mill Creeks, Nelder Creek, and the Lewis Fork of the Fresno River in California, are evaluated with respect to their anticipated impacts on selected target resources. The target resources include: (1) resident trout resource, (2) riparian vegetation, (3) wildlife resources, (4) sensitive species, (5) aesthetics, (6) cultural resources, (7) land use, (8) water use, (9) recreation and (10) local economy. The 12 projects would be operated as run-of-river projects. Each would normally require the installation of a diversion structure, a penstock, a powerhouse containing turbine-generators, a switchyard, transmission lines, and access roads. The total installed energy capacity of all the projects is 32 megawatts, while the average annual energy produced is estimated at 103 gigawatt hours.

14 SOLAR ENERGY

REFER ALSO TO CITATION(S) 14000046103

1401 Resources And Availability

45712 **(LBL—15623) Daylight availability data for San Francisco.** Navvab, M.; Karayel, M.; Ne'eman, E.; Selkowitz, S. (Lawrence Berkeley Lab., CA (USA)). May 1983. Contract AC03-76SF00098. 28p. (CONF-830229—3). NTIS, PC A03/MF A01; GPO Dep. File Number DE84016896.

From International daylighting conference; Phoenix, AZ, USA (16 Feb 1983).

This paper analyzes solar radiation and daylight measurements taken during a four-year period in San Francisco, California. Horizontal and vertical surface measurements were taken by nine sensors at 15-minute intervals under all sun and sky conditions. The data base from which results were derived exceeds 400,000 meas-

urements. Equations are derived for clear sky global, direct, and diffuse illuminance and irradiance on a horizontal surface as a function of solar altitude, and for overcast sky horizontal illuminance and irradiance. The standard deviations for all parameters in the equations are presented to show the scatter in the data. The average illuminance on horizontal and vertical surfaces by hour and by month are presented as isolux contour plots. These data are also displayed as probability distributions, showing the percent of time in a year that a given irradiance or illuminance value will be exceeded. Monthly average values of sunshine probability are determined and compared to long-term NOAA data.

1404 Environmental, Legal, And Institutional Aspects

45713 **(BNL—51676) Health and environmental effects document for photovoltaic energy systems - 1983.** Moskowitz, P.D.; Conveney, E.A.; Crowther, M.A.; Hamilton, L.D.; Morris, S.C.; Novak, K.M.; Perry, P.E.; Rabinowitz, S.; Rowe, M.D.; Sevian, W.A. (Brookhaven National Lab., Upton, NY (USA)). Sep 1983. Contract AC02-76CH00016. 106p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84017179.

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Health risks arising from the fabrication, installation, operation, and decommissioning of photovoltaic energy systems have been studied. Occupational risks from accidental injuries were quantified, and illness-related effects were examined. Although significant illness-related effects are not expected, potential chemical (e.g., phosphine) and physical (e.g., radio-frequency radiation) hazards found in the workplace merit careful consideration. Public health risks from pollutants (e.g., cadmium) emitted throughout the energy cycle and from physical hazards (i.e., electric shock and fire) associated with rooftop decentralized applications were reviewed. The risks from pollutants seem to be larger than the physical hazards considered, but they are highly uncertain. Risks to exposed individuals from electric shock and fire may be significant, but societal risks are probably small. Research needed to reduce uncertainties in these risk assessments includes examination of new materials and fabrication processes, measurements of public and occupational exposures to hazardous chemical and physical environments, and identification of mechanisms and probabilities of fire and electric shock due to photovoltaics applications.

45714 **(DOE/AL/19929—T8) Avoided cost standards and practices under the Public Utility Regulatory Policies Act.** (Solar Energy Industries Association, Washington, DC (USA)). 30 Dec 1983. Contract AC04-82AL19929. 68p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017445.

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This paper examines the relevance of the PURPA legislation, specifically Sections 210 and 201, to solar thermal project developers. It seeks to provide understanding of the avoided cost standard, used by electric utilities to calculate the price paid to small power producers, and of the interconnection and qualifying requirements for such producers. Important actions taken by state public utility commissions and electric utilities are surveyed, and the limited experience of solar thermal projects under PURPA guidelines is reviewed. The most important issues raised for solar thermal systems concern the lack of consistent rate-setting methods, contract terms and prices for power generated, and capacity credits. Interconnection requirements are also discussed.

45715 **(P—500-84-004) Regulations for the California solar tax credit.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 1984. 18p. CEC, 1516 9th Street, Sacramento, CA 95814. File Number TI84901645.

The purpose of this article is to establish guidelines and criteria which specify solar energy systems and energy conservation measures applied in conjunction with solar energy systems which are eligible for state tax credits pursuant to Sections 17052.5, 17208, 23601, and 24349 of the California Revenue and Taxation Code.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 14050045684, 45690, 45691, 45692, 45693, 45694, 45695, 45696, 45700, 45702, 45704, 45707, 46105, 46108, 46172, 46309, 46321, 46612

45716 (CONF-8203178—, pp 38-48) **Energy from wood.** Weiss, R. Jul 1982. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number TI84770366.

From 10. Salzburg economic inquiry; Salzburg, Austria (4 Mar 1982).

The author discusses the past and present availability, exploitation and use of wood for fuel and as a raw material for wood processing and building industry, ways to increase the availability in future by manuring existing forests, by reforesting and planting firewoods and by energetic improvement of processing and combustion. The exploitation, supply and demand of wood in Austria is considered in more detail.

45717 **(DOE/ER/10533—1) Photosensitive molecular arrays: a study of synthetic methods, photoelectric properties, and energy transfer mechanisms. Final technical report, September 1, 1979-August 31, 1983.** Bulkowski, J.E. (Delaware Univ., Newark (USA). Dept. of Chemistry). 15 Dec 1983. Contract FG02-79ER10533. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016338.

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The objective of this project was the synthesis of novel photosensitive molecular arrays to be employed in photoelectrochemical cells for the conversion of sunlight into electricity. The approach made use of metal derivatives of a specially designed amphiphilic porphyrin, meso-tetra($\alpha,\alpha,\alpha,\alpha$-0-octadecylamidophenyl)porphyrin, to form oriented monolayers on SnO_2 electrode supports on which additional layers of water soluble porphyrins could be ordered, one layer at a time, via bifunctional base linking agents. The work included: synthesis, purification, and characterization of the new surfactant porphyrins; demonstration of their propensity for forming stable monolayers at the air-water interface with the porphyrin ring parallel to the aqueous surface; transfer of the ordered monolayers intact to electrode supports; elucidation of their structures, energy transfer, and electrical properties; and construction of multi-layered arrays using bifunctional base linking methods. Luminescence and electronic spectroscopy indicated that one- and two-layered arrays could be successfully prepared, but the multi-layered arrangements were unstable under photo cell testing conditions. During the luminescence studies, an unusual delayed fluorescence emission and up-conversion process were observed which appeared to originate from a dimer of the surfactant porphyrins.

45718 **(DOE/ET/20074—T29) Eucalyptus plantations for energy production in Hawaii, 9061. Monthly progress report, August 1-31, 1984.** (BioEnergy Development Corp., Hilo, HI (USA)). 12 Sep 1984. Contract FC03-78ET20074. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016991.

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This report contains summaries of accomplishments during August 1984 on the optimization of Eucalyptus growth for energy use in Hawaii. Data are presented on height, diameter, and percent survival of plantings and coppices. Budget information is also included. (DMC)

45719 **(DOE/JPL—1012-89) Proceedings of the Flat-Plate Solar Array Project research forum on quantifying degradation.** (Jet Propulsion Lab., Pasadena, CA (USA)). 1 Jun 1983. Contract AI01-76ET20356. 505p. (CONF-821258—). NTIS, PC A22/MF A01. File Number DE84001225.

From Flat-plate solar array project research forum on quantifying degradation; Williamsburg, VA, USA (6 Dec 1982).

For photovoltaic modules to become practical for large-scale electrical power production, they must undergo cost reductions and they must become sufficiently durable to perform reliably for many years. The Flat-Plate Solar Array Project (FSA), managed by the Jet Propulsion Laboratory for the US Dept of Energy, has estab-

lished cost and life goals of $14.00/m² and 20 years. FSA research has identified and advanced technologies with potential for achieving the cost goal, and seeks to identify and advance relevant technologies for meeting the durability goal. The Quantifying Degradation Research Forum addressed identification and quantification of module degradation rates and mechanisms. Acquisition and analysis of degradation data and formulation of analytical models may facilitate assessment of the life potential of hardware designs, prove design criteria for improved hardware, and help develop tests and standards to assure the durability and quality of future modules. To assess long-term durability from short-term field or accelerated testing, it is essential to identify, understand and quantify potential life-limiting damage mechanisms. Approaches to identifying and characterizing degradation mechanisms such as corrosion, cyclic fatigue, photothermal aging, soiling, debonding, and electrical stress effects are addressed. Experience and approaches of other industries in achieving and assuring hardware durability are reviewed and discussed.

45720 **(DOE/JPL/954739—84/06) Study program for encapsulation materials interface for flat-plate solar array (FSA) project. Final report, March 23, 1977-January 31, 1984.** Kaelble, D.H.; Leung, C.L. (Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). Apr 1984. Contract NAS-7-100-954739. 67p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017101.

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The early validation of a 20 year service integrity for the bonded interface in solar cell modules is an important requirement in the Low Cost Solar Array (LSA) project. The sixth and final phase of the program, as reported in this document, generates and validates the necessary design and process principles for achieving long-term interfacial bonding stability (IBS) of Flat Solar Array (FSA) photovoltaic encapsulated systems.

45721 **(DOE/JPL/955567—84-15) Design, analysis and test verification of advanced encapsulation systems. Triannual report for period ending July 31, 1984.** Garcia, A. III. (Spectrolab, Inc., Sylmar, CA (USA)). Aug 1984. Contract NAS-7-100-955567. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017322.

Work in the area of transparent conduction materials has slowed awaiting further funding. Two papers are appended that were presented at the 17th IEEE Photovoltaic Specialists Conference. The first relates the electrical isolation design of photovoltaic modules, and the second discusses the effect of design factors on cell temperatures. (LEW)

45722 **(DOE/JPL/956741—84/02) Comprehensive silicon solar cell computer modeling. Quarterly progress report No. 2, April 5, 1984-July 4, 1984.** Lamorte, M.F. (Research Triangle Inst., Research Triangle Park, NC (USA)). Sep 1984. Contract NAS-7-100-956741. 45p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017384.

A new computer modeling method is described and is applied to silicon solar cells. The method is similar to numerical integration (NI) methods in that both require the use of a mesh point field. The set of transport equations is applied to each mesh point, and, through a judicious selection of the mesh point distribution, an accurate closed-form analytical function is obtained at the assigned mesh point. Application of the boundary conditions, to an f-mesh point field, results in 2f-equations that require simultaneous solution. This solution is manifested through the determination of the 2f-constants of integration, where each closed-form solution, representing a mesh point, contains two constants of integration. Solar cell transport solution is represented by the complete set of constants of integration obtained in the n- and p-regions. Substituting the constants of integration into the corresponding closed-form analytical function, representing an assigned mesh point, results in a set of analytical functions that is applicable only to its assigned region in the mesh point field. As a result, the complete set of closed-form functions describes the behavior of the photoexcited carrier concentration for a continuum of x-values in the n- and p-regions. The photoexcited carrier relationship is used to obtain the current-voltage relationship, from which the maximum power point and conversion efficiency are determined. Effects of temperature, solar concentration, submodel parameters, and structure parameters may be studied. A model is developed to describe the charge distribution that establishes a built-in field. The model requires that a redistribution of majority carriers takes place from the charge neutrality distribution.

45723 **(FRNC-TH—1516) Silicon solar cells.** Salles, Y. (Caen Univ., 14 (France)). Apr 1982. 150p. (In French). NTIS (US Sales Only), PC A07. File Number DE84751845.

A list of patents, publication and contracts, and texts from various literature are presented in this paper. This works represent about twenty years of studies in the photovoltaic field, so the subjects of the different papers are varied. Most works concern studies on terrestrial solar cells. Publications about spatial applications of solar cells are listed in annexe. This bibliography contains 32 citations.

45724 **(FRNC-TH—1650) Optimization of pulling conditions under electron bombardment of polycrystalline silicon ribbons for solar cells.** Vandekerkove, L. (Lyon-1 Univ., 69 (France)). Nov 1982. 144p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE84751847.

The use of Si ribbon crystals as a starting material for the production of solar cells is a promising approach for the cost reduction of the photovoltaic devices. In this view, a drawing process of polycrystal ribbon from silicon powder was developed in our laboratory: an electron gun irradiates the powder surface; at a first step, a preribbon is produced by displacement of the molten zone created by the electron beam which is deflected upon the compacted powder. Then, this self sustained ribbon is recrystallized by using the same technique. The apparatus includes the high vacuum drawing chamber with cryogenics pumping and the devices of electron irradiation and control such as optical pyrometer, video camera, micrometer displacement table; moreover a front and post heating of the irradiated sample is used for obtaining linear thermal gradients next to the molten zone. After theoretical calculations about the repartition of temperatures and stresses into the material and the study of silicon plastic qualities this auxiliary heating device was necessary. An infrared photoelasticimeter device allows us to measure the residual stresses rate versus the drawing experimental conditions. So, it is possible to obtain polycrystal silicon ribbon of about 2 cm wide, some centimeters long and 330 μm thick whith a columnar structure. The silicon ribbon crystals were evaluated by measuring minority carrier diffusion length using a scanning electron microscope in EBIC mode; the results, confirmed with the electrolytical diode technique, indicate that the diffusion length was about 10 μm. At last, the chemical analysis show a molten zone purification process for elements such as Mn, V, W, Al. So, a middling quality silicon powder of lower cost can be used.

45725 **(LBL—18203) Low temperature electron paramagnetic resonance of the photosynthetic oxygen evolving system.** Casey, J.L. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 152p. NTIS, PC A08/MF A01; GPO Dep. File Number DE84016950.

Thesis.

The investigations reported in this work examine the oxidizing reactions of photosystem 2 by the use of EPR. Initial studies confirm the association of the multiline EPR signal with the S_2 state of the oxygen-evolving complex and investigate directly the effects of low temperature on the reactions of the oxygen-evolving system. By the use of low temperature illumination, it is demonstrated that an intermediate state S_1, between the S_1 and S_0 states, can be trapped, and an EPR signal which appears at g 4.1 is assigned to the intermediate. The characteristics of the signal lead to the suggestion that non-heme ferric iron is involved in the oxidizing reactions of photosystem 2. The intermediate state is further characterized by investigations of its behavior at low temperature, after preillumination, and under several conditions for which oxygen evolution is inhibited. 156 references, 22 figures.

45726 **(N—84-12634) Study of multi-kilowatt solar arrays for Earth orbit applications. Final report, 19 November 1980-30 June 1983.** Patterson, R.E. (TRW Space Technology Labs., Redondo Beach, CA (USA)). Oct 1983. 200p. (NASA-CR—170939). NTIS, PC A09/MF A01.

A miniaturized Cassegrainian concentrator (MCC) solar array concept is being developed with the objective of significantly reducing the recurring cost of multikilowatt solar arrays. The desired cost reduction is obtained as a result of using very small high efficiency solar cells in conjuction with low cost optics. The MCC single element concept incident solar radiation is reflected crom primary parabolic reflector to a secondary hyperbolic reflector and finally to a 4 millimeter diameter solar cell. A light catcher cone is used to improve off axis performance. The solar cell is mounted to a heat fin. An element is approximately 13 millimeters thick which permits efficient launch stowage of the concentrator system panels without complex optical component deployments or retractions. The MCC elements are packed in bays within graphite epoxy frames and are electrically connected into appropriate series-parallel circuits. A MCC sngle element with a 21 sq cm entrance aperture and a 20 efficient, 0.25 sq cm gallium arsenide solar cell has the same power output as 30 sq cm of 11-percent efficiency (at 68 C) silicon solar cells.

45727 **(N—84-12637) Transactions of the Chinese Solar Energy Society (selected articles).** Sun, Z.; Xiong, S.; Wang, Z.; Jiang, X.; Yin, W. (Air Force Systems Command, Wright-Patterson AFB, OH (USA)). Aug 1983. 20p. (AD-A—131870). NTIS, PC A02/MF A01.

Topics of discussion include: the Ni/alpha-Si Schottky barrier solar cell, and the heterojunction SnO2/n-Si solar cells.

45728 **(N—84-13978) Simple model of space radiation damage in GaAs solar cells.** Wilson, J.W.; Stith, J.J. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Dec 1983. 31p. (NASA-TP—2242; L—15689). NTIS, PC A03/MF A01.

A simple model is derived for the radiation damage of shallow junction gallium arsenide (GaAs) solar cells. Reasonable agreement is found between the model and specific experimental studies of radiation effects with electron and proton beams. In particular, the extreme sensitivity of the cell to protons stopping near the cell junction is predicted by the model. The equivalent fluence concept is of questionable validity for monoenergetic proton beams. Angular factors are quite important in establishing the cell sensitivity to incident particle types and energies. A fluence of isotropic incidence 1 MeV electrons (assuming infinite backing) is equivalent to four times the fluence of normal incidence 1 MeV electrons. Spectral factors common to the space radiations are considered, and cover glass thickness required to minimize the initial damage for a typical cell configuration is calculated. Rough equivalence between the geosynchronous environment and an equivalent 1 MeV electron fluence (normal incidence) is established.

45729 **(ORNL—6085) Short Rotation Woody Crops Program. Annual progress report for 1983.** Ranney, J.W.; Trimble, J.L.; Wright, L.L.; Perlack, R.D.; Wenzel, C.R.; Cushman, J.H. (Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 96p. NTIS, PC A05/MF A01; GPO Dep. File Number DE84017634.

Environmental Sciences Division Publication No. 2378.

This report describes the activities and accomplishments in the Short Rotation Woody Crops Program (SRWCP) for the year ending September 30, 1983. The program is sponsored by the US Department of Energy's Biomass Energy Technology Division and consists of research projects at 21 institutions and corporations. The SRWCP is an integrated program of research devoted to a single objective: improving the productivity and economic efficiency of short-rotation intensive culture of hardwood trees and shrubs for energy. The introduction states the objectives of the SRWCP, highlights the accomplishments for 1983, and describes the overall research status after 6 years of funding. Technical information is provided for the five major research areas in the program: (1) species screening and genetic selection, (2) stand management, (3) woodhandling equipment and fuel characterization, (4) economic evaluation, and (5) plant productivity and site nutrients. The 1983 accomplishments are described and trends are demonstrated, with graphs and tables summarizing data from several projects. Separate abstracts have been prepared for each of the research areas for inclusion in the Energy Data Base. 40 references, 22 figures, 15 tables.

45730 **(SAND—84-0734C) Overview of photovoltaic concentrator technology.** Arvizu, D.E.; Edenburn, M.W. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016790.

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Concentrator photovoltaics is one of several photovoltaic approaches that could, in the future, provide reliable commercial electric power at a cost competitive with conventional sources. Since the path to providing cost competitive energy is dependent on both the conversion efficiency of the system and its installed cost, concentrators feature a unique approach in that both of these areas are pursued simultaneously. Concentrator technology has been supported by the US Department of Energy's Federal Program for nearly a decade. In that time several systems have been fielded and research has continued to push the development of high efficiency systems. This paper will present the current status and research direction of concentrator photovoltaic technology.

45731 **(SERI/CP—211-2109) Abstracts: National Photovoltaics Program. Annual review meeting.** (Solar Energy Research Inst., Golden, CO (USA)). 1984. Contract AC02-83CH10093. 170p. (CONF-840441—Summs.). NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE84013003.

From DOE annual photovoltaic program review; Kissimmee, FL, USA (30 Apr 1984).

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The twelve brief presentation summaries are separately indexed. (LEW)

45732 **Thin film gallium arsenide solar cells.** Chu, S.S.; Chen, W.J.; Chu, T.L.; Wang, Q.H.; Zhang, F.S. (Southern Methodist University, Dallas, Texas). *Proceedings - Electrochemical Society;* **83-11**: 396-400(May 1983). (CONF-8305161—).

From Conference on materials and new processing technologies for photovoltaics; San Francisco, CA, USA (9 May 1983).

Thin films of gallium arsenide deposited on tungsten/graphite substrates by the reaction between gallium, hydrogen chloride, and arsine have been used for the fabrication of thin film solar cells. MOS solar cells of 9 cm^2 area with an AM1 efficiency of 8.5% have been prepared from ruthenium treated gallium arsenide films of about 10 μm thickness. Homojunction solar cells of $p^+/n/n^+$ configuration of 1 cm^2 area with an AM1 efficiency of 8.8% have been produced using heat treatment immediately following the deposition of the device structure. The major problem associated with polycrystalline thin film cells is the grain boundary shunting effect. To further improve the conversion efficiency, thin gallium arsenide films with uniformly large grains are required unless more effective grain boundary passivation technique can be developed.

45733 **Cadmium telluride solar cells.** Bube, R.H. (Department of Materials Science and Engineering, Stanford University, Stanford, California). *Proceedings - Electrochemical Society;* **83-11**: 359-376(May 1983). (CONF-8305161—).

From Conference on materials and new processing technologies for photovoltaics; San Francisco, CA, USA (9 May 1983).

Cadmium telluride is the only II-VI compound that can readily be prepared in both n- and p-type forms. Since, in addition, its bandgap lies near the optimum for solar energy conversion, it is currently one of the leading contenders for thin film terrestrial solar energy conversion. CdTe based solar cells with an efficiency of greater than 10% have been prepared by a variety of techniques including homojunction formation, chemical vapor transport of CdS to form a CdS/CdTe junction, electron beam evaporation of indium-tin oxide to form an ITO/CdTe junction, by closespaced vapor transport of both CdS and CdTe to form a CdS/CdTe junction, and by sintered layer techniques resulting in an all thin film sintered layer cell. Cells with creditable efficiency have also been prepared by ordinary vacuum evaporation of a window material, by spray pyrolysis deposition of a window material, and by electro-

deposition of thin layers. This paper surveys research on CdTe solar cells and indicates the significant materials and device parameters.

45734 **Processing of MG silicon for photovoltaic applications.** Khattak, C.P.; Schmid, F. (Crystal Systems Inc., Salem, MA). *Proceedings - Electrochemical Society;* **83-11**: 478-489(May 1983). (CONF-8305161—).

From Conference on materials and new processing technologies for photovoltaics; San Francisco, CA, USA (9 May 1983).

This paper describes in situ refinements of as-received, commercially available MG silicon by the Heat Exchanger Method (HEM). Samples of MG silicon from six different sources were directionally solidified and nearly single crystal structure was achieved in 15 cm square ingots. The effect of vacuum, slagging, argon blowing through the melt and double solidification on refinement of impurities was studied. The simultaneous incorporation of vacuum, slagging, moist argon blowing through the melt and a directional solidification reduced the impurities to less than 1 ppm levels. These procedures were also effective in reducing the B and P contents.

45735 **Zinc sulphoselenide thin films for photovoltaic applications.** Leigh, W.B.; Christianos, K.A.; Wessels, B. (Department of Materials Science and Engineering and Materials Research Center, Northwestern University, Evanston, Illinois). *Proceedings - Electrochemical Society;* **83-11**: 457-462(May 1983). (CONF-8305161—).

From Conference on materials and new processing technologies for photovoltaics; San Francisco, CA, USA (9 May 1983).

The electrical and photovoltaic properties of single crystalline ZnSSe/GaAs heterojunction photovoltaic devices prepared by the chemical vapor deposition of ZnSSe on Cd doped GaAs have been investigated. Under simulated solar conditions, a cell without an anti-reflection coating showed an open-circuit voltage of 0.58 V, a short-circuit current of 18.3 mA/cm^2 and an efficiency of 6.4%. The photoresponse of the cells increased with increasing photon energy, indicating the resistivity of the ZnSSe is limiting the cell efficiency.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 14060045713, 45723, 45731, 46160

45736 **(DOE/ET/20279—178) System design drawings for the PV power system at Natural Bridges National Monument.** Baird, R.H.; Solman, F.J. (eds.). (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA); Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). May 1982. Contract AC02-76ET20279. 386p. NTIS, PC A17. File Number DE82017130.

The drawings provided cover the electrical, electronic control, mechanical, and structural systems of the Natural Bridges National Monument Photovoltaic Power System, as well as site preparation, panel foundations, and battery building drawings. (LEW)

45737 **Design and construction experience from photovoltaic installations.** Kauffman, W.R. pp 333-338 of Advances in energy cost savings for industry and buildings. Atlanta, GA; Fairmont Press (1983). (CONF-831115—).

From 6. world energy engineering congress; Atlanta, GA, USA (29 Nov 1983).

This paper presents a brief overview of the following systems for photovoltaic energy developed by BDM: Arco i MW array, the Mississippi Community College hybrid photovoltaic/thermal power system, Commerical application of a PV concentrator, McClellan Air Force base Mini-mart PV System, Southwest PV residential prototype, and the Taiwan Energy Research Laboratory. The paper focuses on the unique design features of the systems and problems encountered in construction, startup and initial operation of the arrays.

45738 **Design and operational experience of the Solarex breeder.** Macomber, H. pp 339-342 of Advances in energy cost savings for industry and buildings. Atlanta, GA; Fairmont Press (1983). (CONF-831115—).

From 6. world energy engineering congress; Atlanta, GA, USA (29 Nov 1983).

This paper describes in detail the Photovoltaic power system for the Solarex Solar Breeder facility, designed by the Solarex Corporation. The elements of the PV system include the PV array, PV modules, power collection, power conditioning, distribution and conversion, battery, battery conditioning, emergency generator, control, and reliability design and operational considerations. Initial operatings problems and solutions are also listed.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 14070045714

45739 **(DOE/AL/19929—T9) Assessment of solar thermal energy market development and macro economic impacts.** La Porta, C. (Solar Energy Industries Association, Washington, DC (USA)). May 1984. Contract AC04-82AL19929. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017446.

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The objective of this study is to furnish an industry estimate of future sales for the three major solar thermal technologies: parabolic trough, parabolic dish, and central receiver. Along with these market projections, information was also sought on: the impact of varied levels of the federal business energy investment credit; projected displacement of conventional energy; investment capital requirements; and direct and indirect employment generated. The report is organized in three major sections. In the first, the market penetration estimates for each technology developed from industry data are briefly reviewed. In the second, the assumptions, values and methodology used to prepare the employment and treasury income assessment are presented. In the third, the results of the analysis and discussion are reported.

45740 **(DOE/SF/10501—064) 10 MWe solar thermal central receiver pilot plant: project summary report and lessons learned.** (Southern California Edison Co., Rosemead (USA); USDOE Solar One Project Office, Daggett, CA; Los Angeles City Dept. of Water and Power, CA (USA); California Energy Resources Conservation and Development Commission, Sacramento (USA)). Jun 1982. Contract FC03-77SF10501. 156p. (STMPO—598). NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE84017038.

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This summary level report was prepared by the DOE Solar Ten Megawatt Project Office (STMPO) to: (1) briefly describe the Pilot Plant; (2) provide design and fabrication lessons learned for future industrial developers; and (3) identify a bibliography of project reports and contacts for detailed reference. The time period covered is from the completion of conceptual design in 1977 through completion of construction and achievement of Turbine Roll on April 12, 1982, whereby solar generated electric power was first fed to the utility grid. A listing of currently available contacts and reports from each participating organization is included in the bibliography.

1408 Ocean Energy Systems

45741 **(SERI/TP—252-2330) Open cycle OTEC thermal-hydraulic systems analysis and parametric studies.** Parsons, B.; Bharathan, D.; Althof, J. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1984. Contract AC02-83CH10093. 10p. (CONF-840930—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84013011.

From OCEANS '84 conference and exposition; Washington, DC, USA (10 Sep 1984).

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An analytic thermohydraulic systems model of the power cycle and seawater supply systems for an open cycle ocean thermal energy conversion (OTEC) plant has been developed that allows ready examination of the effects of system and component operating points on plant size and parasitic power requirements. This paper presents the results of three parametric studies on the effects

of system temperature distribution, plant gross electric capacity, and the allowable seawater velocity in the supply and discharge pipes. The paper also briefly discusses the assumptions and equations used in the model and the state-of-the-art component limitations. The model provides a useful tool for an OTEC plant designer to evaluate system trade-offs and define component interactions and performance.

45742 **(SERI/TR—255-1599) Research approaches to qualify aluminum for Ocean Thermal Energy Conversion (OTEC) systems.** Russell, P.; Pohlman, S.; Gross, G. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1984. Contract AC02-83CH10093. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84013007.

This report summarizes the efforts of the Solar Energy Research Institute's Materials Research Branch in the technical support of Ocean Thermal Energy Conversion (OTEC) power systems. The report presents the results of an intense literature search and discusses the test loops being operated in support of OTEC. It also includes the preliminary findings of electrochemical experimentation that generate support information. A brief overview of this program was presented for review at the annual meeting of the National Association of Corrosion Engineers (NACE) in April 1981. Comments and suggestions from that review are included. Finally, an approach to addressing those areas of continued concern is offered.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 14090045678, 46118, 46134, 46152

45743 **(ANL/ES—139) Central solar heating plants with seasonal storage: basic performance, cost, and operation of solar collectors for heating plants with seasonal storage.** Bankston, C.A. (Argonne National Lab., IL (USA)). May 1983. Contract W-31-109-ENG-38. 195p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE84016046.

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This report - prepared as a part of the International Energy Agency's Solar Heating and Cooling Program, Task VII (Central Solar Heating Plants with Seasonal Storage [CSHPSS]), Subtask 1(b) (Solar-Collector Subsystems) - reviews the performance and cost of, as well as operating experience with, collector subsystems suitable for CSHPSS application. The types of collectors considered include horizontal collectors (solar ponds), stationary nonconcentrating collectors, distributed line-focus tracking collectors, and central-receiver tracking collectors. Design, installation, and operational considerations are discussed, and performance and cost models are recommended for use in the preliminary design phase of Task VII. Comparing the collector subsystems in terms of idealized CSHPSS use, the subtask participants find the tracking collectors to be most attractive for many locations.

45744 **(BNL—51638) Solar-assisted heat pumps: impact of evaporator characteristics on performance.** Catan, M.A. (Brookhaven National Lab., Upton, NY (USA)). Mar 1982. Contract AC02-76CH00016. 33p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017169.

Five water-refrigerant heat exchangers were tested as part of a program of experimental studies of solar-assisted heat pump (SAHP) components and controls. The aim of this work is to establish ways of improving on the benchmark designs of two prototype SAHPs, one each built by Northrup Incorporated and Lennox Industries Incorporated under contract to the US Department of Energy (DOE). The performance of a water source heat pump, employing any of these evaporators, can be projected using these data, in conjunction with appropriate data pertaining to the rest of the heat pump. Thus, the impact of the evaporator's characteristics on the heat pump performance as a whole may be assessed. The necessary supplementary data may be obtained from compressor curves and condenser performance data, or from test data from a heat pump for which substitution of one of the evaporators considered in this report is contemplated. The steady state performance of the Northrup prototype SAHP employing each of the heat exchangers tested is projected using these test data. The projections of coefficient of performance (COP) versus entering water temperature performance are presented along with the original test data for comparison.

45745 (CONF-8203178—, pp 21-24) **Utilization of solar energy: Practicabilities, techniques and applications in Austria.** Faninger, G. Jul 1982. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number TI84770366.

From 10. Salzburg economic inquiry; Salzburg, Austria (4 Mar 1982).

Solar energy in Austria is utilized for warm water heating and for heating of swimming pools. Flat plate collectors are above all employed (95.000 m^2 is the total of installed collectors till the end of 1981). Heat pumps are employed in Austria (10.000 plants till 1981) for warm water heating, space heating and swimming pool heating. Other possibilities of solar energy utilization are shortly introduced (e.g. solar cells, artificial hydrogen photlysis) but it is stated that they not yet work in practice in Austria.

45746 **(DOE/CE/30804—T1) Commercial applications of solar feasibility and financing conference and exhibit. Final report.** Weissman, N.; Kaminsky, N. (Mid-Atlantic Solar Energy Association, Philadelphia, PA (USA)). 1984. Contract FG02-84CE30804. 96p. (CONF-840559—Summ.). NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84015914.

From Commercial applications of solar conference and exhibit; Philadelphia, PA, USA (30 May 1984).

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A program on commercial solar and conservation installations was developed to increase regional awareness of how large-scale solar, when used in conjunction with energy management and conservation, can be utilized and financed in a cost effective manner. This report contains summaries of each presentation and some conference packet material.

45747 **(DOE/CS/30333—T1) Comal County MHMR Center passive solar demonstration program. Operation and evaluation final report.** Svedeman, S.J.; Stubblefield, J.; Wyatt, R. (Southwest Research Inst., San Antonio, TX (USA); Stubblefield (J.), San Antonio, TX (USA); Comal County MHMR Center, New Braunfels, TX (USA)). Oct 1983. Contract FC02-80CS30333. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84016337.

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A stone school building, built in New Braunfels, Texas in 1934, was renovated for use as a mental health facility. Included in the renovation of the 4805 ft^2 building were cost effective passive solar and conservation options. The total cost for building renovation was $125,000 with the cost of the energy related options totaling $14,000. The passive solar and conservation options included in building construction were ceiling insulation, weather proofing, fluorescent lighting, roof evaporative spray cooling systems, awnings, and ceiling fans. Natural ventilation and night cooling are used to reduce the cooling load. Natural daylighting is utilized to replace the dependence on artificial lighting. The yearly space heating energy consumption at the MHMR Center was 16,000 Btu/ft^2/year. The energy usage for lighting (including ceiling fans), water heating, and air conditioning was 7380 Btu/ft^2/year, 2070 Btu/ft^2/year, and 3700 Btu/ft^2/year, respectively. Approximately 23% of the lighting load was for external night lighting. The average monthly utility bill, including natural gas and electric, for the 4805 ft^2 building was $171.

45748 **(DOE/R5/10230—T1) Low cost passive solar demonstration project.** Boese, B. (Northwest Michigan Human Services Agency, Traverse City (USA)). 20 Apr 1981. Contract FG02-80R510230. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016953.

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The objective of this demonstration project was to design and construct a passive solar space heating unit for installation on 20 houses of low-income families. The main concern was to keep the cost as low as possible through the use of locally available ma-

terials and simple construction techniques. Data collected on two locations are presented.

45749 **(DOE/R8/08005—T1) Combined active/passive solar-heating system. Final report.** Scott, R.W.; Scott, B.J. (Scott (Richard W. and Beverly J.), Riverton, WY (USA)). 13 Apr 1983. Contract FG48-81R808005. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84015778.

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This report details work completed on the construction of a combined active/passive solar heating system. This was to be based on and include the following: (1) active collecting surfaces on an existing garage roof; (2) a heat storage system; (3) a blower and heat distribution system; (4) a passively heated solar greenhouse, with an active assist; (5) an atrium to assist in passive heating of the existing house; (6) a thermal wall to hold heat for the greenhouse and transfer heat to the house (and, conversely, to transfer heat from the house to greenhouse); a waste heat redistribution or destratification system; and (8) a backup wood-heating system. The passive system is reported as performing well; the active system is yet to be tested.

45750 **(DOE/R8/08028—T1) Camp Sacajawea Passive Solar Demonstration Project.** (Wyoming Girl Scout Council, Casper (USA)). 31 Aug 1983. Contract FG48-81R808028. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84015782.

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The intent of the Passive Solar Demonstration Project was to have: an actual demonstration of the effectiveness of a passive solar design and working automatic shading devices; accurate data of energy saved by the passive design and shading devices; a brochure distributed to architects, builders, and consumers, with the monitoring data and information about the project; and the continued monitoring of the building to help explain to those who are using the building the value of the system; this would not only include the 7000 members, bu visitors and other users of the facility. To accomplish these goals, a monitoring system was installed in the recently build Passive Solar Lodge at Camp Sacajawea on Casper Mountain south of Casper, Wyoming. The building was monitored continously for the remainder of the project. The installation of the automatic shading device, a curtain wall was accomplished but had some difficulty. The results indicate there is some effectiveness of the Curtain Wall, but a quantitative value would be impossible at this time.

45751 **(DOE/R8/08031—T1) Solar heating for a commercial-sized swimming pool. Final report.** Kane, J.M. (Sun Valley Community Club, Inc., Cheyenne, WY (USA)). 12 Nov 1983. Contract FG48-81R808031. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84015787.

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The task of the project was to build a solar heating system for a large community pool. Racks for the sixty collectors were constructed of redwood as described in the section on carpentry work. The plumbing section details the ease of putting together the collectors as well as the difficulty of hooking up the pipe to the pumps and inline filters. An automatic controller unit turns the pumps on and off depending on the availability of sunlight. After two years of work, the system is operable, but the pool cover purchased in the first year may be more effective than the entire solar heating system. Optimal solar efficiency may not be practical. The details of this finding are discussed in the section on conclusions, pitfalls, and recommendations.

45752 **(LA-UR—84-2565) Numerical and experimental studies of thermosiphon passive heating systems.** Schnurr, N.M.; Wray, W.O. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 7p. (CONF-840954—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016749.

From 9. national passive solar conference; Columbus, OH, USA (23 Sep 1984).

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A numerical analysis was used to predict the performance of a thermosiphon passive solar heating system. The numerical method is an adaptation of the PASOLE code including a calculation procedure for flow in the thermosiphon channel. A Los Alamos National Laboratory test cell was used to obtain experimental data for several configurations. Comparisons of experimentally measured collector surface temperatures and auxiliary heating energy requirements, with values predicted by numerical simulations, showed good agreement for the system without a backdraft damper. Experiments were also run using a backdraft damper consisting of a Tedlar flap and wire mesh covering the upper vent. Comparisons of experimental data with the results of a numerical simulation indicated that this relatively crude damper was approximately 35% effective.

45753 **(LA-UR—84-2650) Natural air motion and stratification in passive buildings.** Balcomb, J.D.; Jones, G.F.; Yamaguchi, Kenjiro. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 7p. (CONF-8409118—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016830.

From Passive and hybrid solar energy update; Washington, DC, USA (5 Sep 1984).

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Natural convection is a major mechanism for heat distribution in many passive solar buildings, especially those with sunspaces. To better understand this mechanism, observations of air velocities and temperatures have been made in 13 different houses that encompass a wide variety of one- and two-story geometries. This paper extends previous reports. Results from one house are described in detail, and some generalizations are drawn from the large additional mass of data taken. A simple mathematical model is presented that describes the general nature of airflow and energy flow through an aperture.

45754 **(LA-UR—84-2724) Cooling load estimation methods.** McFarland, R.D. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 8p. (CONF-8409118—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016793.

From Passive and hybrid solar energy update; Washington, DC, USA (5 Sep 1984).

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Ongoing research on quantifying the cooling loads in residential buildings, particularly buildings with passive solar heating systems, is described. Correlations are described that permit auxiliary cooling estimates from monthly average insolation and weather data. The objective of the research is to develop a simple analysis method, useful early in design, to estimate the annual cooling energy required of a given building.

45755 **(LA-UR—84-2725) Vapor phase heat transport systems.** Hedstrom, J.C. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 8p. (CONF-8409118—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016794.

From Passive and hybrid solar energy update; Washington, DC, USA (5 Sep 1984).

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Vapor phase heat-transport systems are being tested in two of the passive test cells at Los Alamos. The systems consist of an active fin-and-tube solar collector and a condenser inside a water storage tank. The refrigerant, R-11, can be returned to the collector by a pump or by a self-pumping scheme. In one of the test cells the liquid was self-pumped to the roof-mounted collector 17 ft above the condenser. A mechanical valve was designed and tested that showed that the system could operate in a completely passive mode. Performance comparisons have been made with a passive water wall test cell.

45756 **(LA-UR—84-2735) Potential performance benefits of advanced components and materials research.** Neeper, D.A.; McFarland, R.D.; Hedstrom, J.C.; Lazarus, G.S. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 7p. (CONF-8409118—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016771.

From Passive and hybrid solar energy update; Washington, DC, USA (5 Sep 1984).

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This paper reports work in progress to identify the potential impact of new components and materials on the energy savings, comfort, or utility of buildings. As of this writing, three new items have received preliminary examination. Wallboard containing phase change material (PCM) for thermal storage appears very promising. PCM combined with sensible storage can significantly reduce the storage volume in water walls, liquid convective diodes, and hybrid heating systems. Aerogel window glazings with present aerogel properties appear to be superior to existing materials only in applications with low insolation or very cold temperatures, but an increase in optical transmission of the material could lead to a glazing that is superior in all climates with significant winters.

45757 **(LA-UR—84-2736) Liquid convective diodes.** Jones, G.F. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 8p. (CONF-8409118—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016772.

From Passive and hybrid solar energy update; Washington, DC, USA (5 Sep 1984).

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Liquid convective diodes are analyzed by experiments and theory. The experiments include flow visualization and temperature measurements. The dynamic behavior of a diode is analyzed and explained. Performance of three diodes of different designs that were installed in a test cell this past winter showed an average 50% thermal efficiency over a three-month period. If only the performance of the most efficient diode among the three is considered, it is expected that this figure may be increased to 60% or possibly 65% with some design improvements. A simple analytical model, which was developed earlier, is discussed. A comparison of reservoir temperatures from one of the test cell diodes with predicted temperatures from the model showed excellent agreement. The good agreement indicates that the model contains the elements that are necessary to accurately predict site-specific diode performance.

45758 **(LA-UR—85-2639) Natural convection airflow measurement and theory.** Balcomb, J.D.; Jones, G.F.; Yamaguchi, Kenjiro. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 7p. (CONF-840954—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016829.

From 9. national passive solar conference; Columbus, OH, USA (23 Sep 1984).

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Natural convection is a major mechanism for heat distribution in many passive solar buildings, especially those with sunspaces. To better understand this mechanism, observations of air velocities and temperatures have been made in 13 different houses that encompass a wide variety of one- and two-story geometries. This paper extends previous reports. Results from one house are described in detail, and some generalizations are drawn from the large additional mass of data taken. A simple mathematical model is presented that describes the general nature of airflow and energy flow through an aperture.

45759 **(NP—4770400) Design of the solar system of the solar house Obdach as a measuring station of the Austrian measuring network for the utilization of solar energy assisted by the data recording system 'HELIO-DATA 1'.** Maslo, A.; Held, E. (AL-KO Kober G.m.b.H., Obdach (Austria)). 19 Jul 1982. 250p. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE84770400.

Study on the solar house Obdach. Detailed information on effects and interrelationship of the various parts and components of house and heating system. Generally valid statements for the planning of similar objects are made.

45760 **(NP—4901347) Fabrication and testing of full-scale working prototype of solar furnace for metallurgical uses. Final report.** (Indian Inst. of Science, Bangalore. Dept. of Mechanical Engineering). 1983. 76p. NTIS (US Sales Only), PC A05/MF A01. File Number DE84901347.

This report gives a review of a technical-economic feasibility study of solar furnaces for metallurgical uses and details of the experiments conducted on the 3 metre dia solar furnace first developed and on the 4 metre dia solar furnace subsequently completed. Design details, tracking particulars, temperature measurements, heat treatment and melting trials and a cost benefit analysis constitute the major part of this report.

45761 **(NP—4901354) Techno-economic feasibility study of solar furnaces for metallurgical uses. Final report.** (Indian Inst. of Science, Bangalore. Dept. of Mechanical Engineering). 1982. 52p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84901354.

This feasibility study discusses the following: Solar furnaces of yester years; Merits and demerits of solar furnaces; Radiation collection and considerations on the use of solar furnaces; Reflector - sphere versus paraboloid; Choosing a collector and reflector; Concentration systems; Concentration and temperature; Flux density variation near focus; Sun tracking; Calculation of reflector dimensions for a furnace to melt 10 kg of aluminum; Cost-benefit analysis; Possible problems in fabrication of the reflector; and Availability and utilization of ready-made dish structures.

45762 **(SERI/TR—253-2161-Vol.1) Industrial process heat data analysis and evaluation. Volume 1.** Lewandowski, A.; Gee, R.; May, K. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1984. Contract AC02-83CH10093. 120p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84013013.

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The Solar Energy Research Institute (SERI) has modeled seven of the Department of Energy (DOE) sponsored solar Industrial Process Heat (IPH) field experiments and has generated thermal performance predictions for each project. Additionally, these performance predictions have been compared with actual performance measurements taken at the projects. Predictions were generated using SOLIPH, an hour-by-hour computer code with the capability for modeling many types of solar IPH components and system configurations. Comparisons of reported and predicted performance resulted in good agreement when the field test reliability and availability was high. Volume I contains the main body of the work: objective, model description, site configurations, model results, data comparisons, and summary. Volume II contains complete performance prediction results (tabular and graphic output) and computer program listings.

45763 **(SERI/TR—253-2161-Vol.2) Industrial process heat data analysis and evaluation. Volume 2.** Lewandowski, A.; Gee, R.; May, K. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1984. Contract AC02-83CH10093. 394p. NTIS, PC A17/MF A01; 1; GPO Dep. File Number DE84013014.

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The Solar Energy Research Institute (SERI) has modeled seven of the Department of Energy (DOE) sponsored solar Industrial Process Heat (IPH) field experiments and has generated thermal performance predictions for each project. Additionally, these performance predictions have been compared with actual performance measurements taken at the projects. Predictions were generated using SOLIPH, an hour-by-hour computer code with the capability for modeling many types of solar IPH components and system configurations. Comparisons of reported and predicted performance resulted in good agreement when the field test reliability and availability was high. Volume I contains the main body of the work; objective model description, site configurations, model results, data comparisons, and summary. Volume II contains complete performance prediction results (tabular and graphic output) and computer program listings.

45764 **(SERI/TR—253-2185) Analysis of the effects of active solar energy system control sensor degradation on system performance.** Farrington, R.B.; Short, W. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1984. Contract AC02-83CH10093. 29p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84013023.

The determination of proper control setpoints for active solar energy systems has been discussed by numerous authors. Varying the differential-off setpoints has been thought to contribute

only additional parasitic energy costs. This work shows that the effect of varying the differential-off setpoint is much more significant than that. Laboratory testing at SERI has shown that sensor response can drift by as much as 12 C. The sensor testing and results are briefly reviewed. A negative differential-off setpoint results in the continued pup circulation keeping the collector sensor warmer than the ambient are, and in fact, it will keep it very close to the storage tank temperature. As a result, the pump will continue to operate with no irradiation leading to high thermal losses. Analytical expressions are developed and presented that determine the ambient air temperature required to turn the pump off as a function of the (negative) differential-off setpoint and storage tank temperature. The results show that a negative differential setpoint can effectively reduce the net collected energy by 50% and increase the auxiliary energy requirements by 300%.

45765 **(SERI/TR—253-2187) Failure testing of active solar energy components.** Farrington, R.B. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1984. Contract AC02-83CH10093. 71p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84013024.

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Component and system reliability of active solar energy systems continue to be a major concern of designers, manufacturers, installers, and consumers. Six test loops were constructed and the Solar Energy Research Institute, in Golden, Colorado, to thermally cycle active solar energy system components. Drain valves, check valves, air vents, vacuum breakers, tempering valves, and polybutylene pipe were included in the testing. The test methods and results are discussed in this report. Test results show poor reliability of some of the components and limited performance from others. The results lead to a better understanding of certain failures in the field and present designers with realistic expectations for these components. Recommendations are given to improve component reliability and for further testing.

45766 **(SERI/TR—253-2340) Analysis of an active charge/passive discharge solar space conditioning system employing air collectors and hollow-core concrete block floor.** Short, W.; Kutscher, C.F. (Xerox Corp., Webster, NY (USA). Webster Research Center). Jul 1984. Contract AC02-83CH10093. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84013018.

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The performance and economics of a residential hybrid solar space heating system with 18.5 m^2 (200 ft^2) of roof-mounted air collectors and a hollow-core slab that discharges directly to the space by radiation and convection are examined. In addition to space heating, the system provides domestic hot water heating and summer cooling by night venting of the slab. The system is assumed to be installed in a fairly tight new house with a floor area of 140 m^2 (1500 ft^2) and 7 m^2 (75 ft^2) of south-facing glazing. The TRNSYS computer code was used to develop an annual simulation of the house and the hybrid system and to perform sensitivity analyses for climate, collector characteristics, slab design, heating loads, and controls. The economics and performance of the hybrid system are shown to be comparable to those of an active/rockbed system.

45767 **Reliability and maintenance of solar domestic hot water systems.** Wolosewicz, R.M.; Vresk, J. (Argonne National Laboratory, Argonne, IL). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **89**: No. 2B, 913-931(Jun 1983). (CONF-830640—).

From ASHRAE conference; Washington, DC, USA (26 Jun 1983).

The maintenance requirements of solar domestic hot-water (DHW) systems depend on system reliability. In this paper, the reliabilty of five generic solar DHW systems, which are typical of those installed throughout the United States, is assessed. Reliability block diagrams are used to evaluate the following conditions: freezing, overheating, and lack of hot water. The minimum instrumentation needed to verify system performance is described. Recommendations are presented for designers and manufacturers of solar DHW components and systems.

45768 **Solar research at the Lawrence Berkeley Laboratory.** *Sunworld;* **7**: No. 1, 26-32(Spr 1983).

Two solar research projects being carried out by the Solar Energy Group at the Lawrence Berkeley Laboratory of the University of California at Berkeley are discussed. The projects are: passive solar research and development and solar energy and the microstructure of materials.

45769 **Tropical window solar water heater.** Pytlinski, J.T. pp 107-111 of Advances in energy cost savings for industry and buildings. Atlanta, GA; Fairmont Press (1983). (CONF-831115—).

From 6. world energy engineering congress; Atlanta, GA, USA (29 Nov 1983).

A conceptual breakthrough in solar water heating in the form of a tropical window solar water heater is described. A louvered window that is mass produced and commonly used in Puerto Rico and the Caribbean is employed as a solar collector by replacing louvers with solar radiation absorbing surfaces. The copper thermafin absorbers act as louvers and as solar heat collectors. The window functions as a normal window while operating as a solar collector-water heater. The cost of the tropical window solar collector is in the range of $75/sq.m. ($7/sq.ft.) whereas the cost of a flat-plate solar collector is about $215/sq.m. ($20/sq.ft.). Because of its technical simplicity and low cost, this novel system has the potential to be manufactured and commercialized in the Caribbean, Latin America, Asia and the Middle East. A detailed description of the system construction and operation is provided and illustrated by photographs and schematics. Various ways in which the tropical window solar water heating system can be incorporated into water heating installations already marketable are mentioned. And, other advantages of the system related to energy conservation and security are briefly discussed. The research installation used to evaluate the thermal performance of the tropical window solar water heater is described and some details about the measuring procedure are given. Finally, the research program being conducted is presented, and the preliminary results of the thermal performance of a single tropical window used as a solar water heater are discussed.

45770 **Cost savings through first cost reduction.** Burrows, D.L. pp 97-101 of Advances in energy cost savings for industry and buildings. Atlanta, GA; Fairmont Press (1983). (CONF-831115—).

From 6. world energy engineering congress; Atlanta, GA, USA (29 Nov 1983).

Eleven Commercial and Industrial (C & I) solar projects are reported on from TVA's C & I solar water heating project. Three basic design approaches are discussed: drainback, glycol, and shallow solar pond. Collector types include: flat plate, parabolic, evacuated tube, and pond. Cost breakdowns are described by nine categories including: collectors, support structures, storage, piping, energy transport, insulation, and electrical/ controls. Collector sizes range from 2424 square feet to 74 square feet. System cost ranged from $26 per square foot to $90 per square foot. The merits or drawbacks of the design/construction sequence for three selected systems will be discussed with emphasis on possible first cost reduction. With more data on installed cost and system performance and the working knowledge of the performance of a generic collector type, estimates of the cost/performance for a generic system type could be made. Only cost information will be presented in this report although system performance figures for the instrumented systems will be completed in the future.

45771 **Design of a modular industrial solar steam generator.** Reynolds, T.O. pp 103-106 of Advances in energy cost savings for industry and buildings. Atlanta, GA; Fairmont Press (1983). (CONF-831115—).

From 6. world energy engineering congress; Atlanta, GA, USA (29 Nov 1983).

BDM has designed a Modular Industrial Solar Retrofit (MISR) system that is cost effective and reliable using standard commercial products with emphasis on standard fabrication and installation techniques. This design is based on experience gained by BDM in previous solar IPH programs. The BDM MISR design is a packaged, augmentary solar industrial steam generator featuring automatic or manual override control of the constant flow, modular

array field, and mechanical and electrical skids. The MISR contains 25,200 square feet of Solar Kinetics T-700 linear parabolic trough collectors. The collector field is configured in five delta-T loops each containing 36 T-700 collectors and totaling 5,040 square feet. End manifolding is provided as the most cost effective and functional piping configuration. The BDM MISR system can be configured in either north/south, east/west or intermediate orientations, depending on the profile of the demand and other site specific constraints. The mechanical skid contains an expansion tank, pump, fire protection system, piping, and valving. The smaller electrical skid contains the hazard panel, central master controller, backup power generator transfer switch, and utility electrical interfaces. It is located near the mechanical skid at a sufficient distance to satisfy fire safety codes. Also located near the mechanical skid is the nonfired steam generator skid. The array field design and skids have been arranged to allow easy access to all valves, controls, and major piping systems for easy installation and maintenance. This system has been designed for production as a commercial packaged system, in that the majority of the system subassemblies are fabricated and shipped to the field as completed units. This allows cost reductions in the production of MISR systems and improves quality control and assurance.

45772 **Data acquisition in test modules.** Moore, F. (Miami Univ., Oxford, OH). *Passive Solar Journal;* 1: No. 4, 219-228(Fal 1982).

Various current monitoring techniques and equipment available for test modules are described and evaluated, including measurement devices such as pyranometers, pyrheliometers, thermocouples, platinum resistance temperature detectors, thermistors, and temperature transducers, as well as recording equipment. Recommended methods for measuring temperature condition, air movement, and power consumption are also explored. Monitoring equipment is discussed in terms of both usability and cost.

45773 **Mastin double-envelope house: comparing the Brookhaven results to an SLR analysis.** Balcomb, J.D. (Los Alamos National Lab., NM). *Passive Solar Journal;* 1: No. 3, 173-174(Sum 1982).

In Report BNL-51460, the Mastin double envelope house was analyzed for its thermal performance. An additional analysis was performed to see how the building might perform if it were treated as a simple sunspace design without a convective loop and how this would compare with the results that was obtained in the BNL report. The results of the analysis and comparison are presented.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 14100045743, 45760, 45761

45774 **(DOE/CS/35359—T1) Solar collectors. Final report.** Baum, B.; Binette, M. (Springborn Labs., Inc., Enfield, CT (USA)). Jun 1983. Contract AC04-78CS35359. 169p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE84011488.

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A broad information search was carried out in four areas: glazings, housing materials, acrylic coatings, etching processes and AR coatings. An extensive list of all (known) US transparent polymers was developed as well as tables of plastic, ceramic and metallic materials that could conceivably function as a housing. In addition, a compilation was made of commercially available solvent and water-base acrylic coatings for use as a uv protective coating for the glazing. Twenty transparent polymers were chosen as possible glazings and twelve materials (plastic and wood) as possible housings and exposed in the Weather-Ometer. The glazing materials were also exposed outdoors at Hazardville, Connecticut, in the EMMAQUA in Arizona, and under the Wet RS-4 Sunlamp. Solar optical transmission and tensile properties were measured periodically. Several acrylic coatings containing uv absorbers were investigated as protective coatings for glazings and the coated glazings were exposed in the EMMAQUA. Tedlar 20 and Halar 500, with strong absorption in the uv, and two commercial films containing uv absorbers, Tedlar UT and Korad 201-R, were laminated by several different processes to four promising glazing materials and exposed in the Weather-Ometer. Antireflective coatings and surface etching processes were explored as a means of increasing transmission by reducing reflection. The results of these studies are presented.

45775 **(FR—84-35/ASC) Holographic solar concentrator development (Phase I). Annual report, August 1, 1983-July 31, 1984. Draft final report.** (Acurex Corp., Mountain View, CA (USA)). 20 Aug 1984. Contract AC03-83SF11941. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84016521.

Research investigations for the first year of the program to investigate the feasibility of utilizing a holographic optical element (HOE) for solar thermal concentrator development are summarized. The following conclusions are made: Point-focus and line-focus holograms have been constructed for both transmission and reflection. Reflection holograms have thus far been shown to have the highest diffraction efficiencies. However, the optical efficiency (reflected sunlight) is still too low. Transmission line-focus holograms are still being considered, but transmission point focus holograms do not appear to be effective, as their spectral spread is considerable. One of the prime results has been to show that holographic reconstruction of sunlight to a white focus (with red fringes) is achievable. The rainbow effect is essentially circumvented. Another key achievement has been the definite demonstration of high monochromatic diffraction efficiency (greater than 90 percent). Initial steps towards producing concentrated line- and point-focus sunlight have succeeded. Geometric concentration ratios of 32 to 64 for line-focus and 87 to 196 for point-focus have been achieved. Initial multiplexing efforts appear to be promising. Environmental test results to date do not show any significant degradation effects.

45776 **(LA-UR—84-2422) Progress on solar absorber selective paint research.** Moore, S.W. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 10p. (CONF-840872—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84015536.

From SPIE annual technical symposium; San Diego, CA, USA (19 Aug 1984).

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A considerable amount of effort has been expended by the Department of Energy (DOE) and by commercial interests to develop solar absorber selective paints; the goal is to develop an inexpensive, durable selective coating that has moderately good optical properties. This report is intended to focus on those research programs monitored by Los Alamos, the research efforts in progress at Los Alamos, durability evaluations, and the progress that has been made toward commercialization.

45777 **(SERI/TP—255-2387) Effective antireflection coatings of transparent polymeric materials by gas-phase surface fluorination.** Jorgensen, G.; Schissel, P. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1984. Contract AC02-83CH10093. 9p. (CONF-840872—24). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84013027.

From SPIE annual technical symposium; San Diego, CA, USA (19 Aug 1984).

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There is a dramatic need in solar energy collection systems for lightweight, inexpensive polymeric materials that exhibit improved performance and durability. One approach to altering the properties of polymeric materials, surface fluorination, is appealing because of its potential for low cost. The literature indicates that such properties as permeability, wettability, bondability, thermal stability, weatherability, and optical transmittance can be improved by treating the surface with gaseous fluorine. A gas phase fluorination reactor system (GPFRS) was designed, built, and used. The initial emphasis was on improving optical transmittance by having an effective antireflection coating form on the surface of a wide variety of commercially available transparent polymeric films. These included such materials as polypropylene, acrylic, polyacrylonitrile, highly cross-linked polyethylene, polyester, polycarbonate and polymethylpentene. Two techniques were used to quantify the effect

of exposing the surface of the polymers to gaseous fluorine. Transparent films were characterized before and after fluorine exposure by specular transmittance measurements. Surface analysis of selected treated and untreated samples was accomplished by x-ray photoelectron spectroscopy and depth profiling. Surface analysis confirmed the deposit of fluorine at the surface and into the bulk of all specimens examined after treatment in the GPFRS. Optical measurements revealed substantial improvement in specular transmittance following surface fluorination of almost all materials considered. Increases in solar weighted specular transmittance as high as 4.6% were measured.

45778 **(SERI/TR—252-2052) Doubly diffusive linear stability with nonconstant gradients.** Zangrando, F.; Bertram, L. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1984. Contract AC02-83CH10093. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84013008.

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The effect of variable stratification on the linear bifurcations of a doubly diffusive plane parallel layer are examined numerically by expanding in a Fourier series. Because the motivation is analysis of solar pond stability, a Prandtl number of 7 and ratio of diffusivities of 1/80 is used in the study, with (large) solute Rayleigh numbers (Rs) ranging from 10^4 to 10^{12}. Stratification of solute is a cubic antisymmetric about midlayer; because temperature has a higher diffusivity, it is given a linear stratification. The numerical results approach Walton's perturbation solution at large Rs, but differ significantly at smaller Rs ($<10^8$). While both exchange of stabilities and overstable modes display an expected tendency to localize about the point of minimum solute gradient, the overstable modes behave in other, nonintuitive, ways. Localization, if extreme enough, can even stabilize small sublayers of reversed salinity gradient. Above $Rs = 10^{12}$, computations become prohibitively expensive as a continuous spectrum is approached. A simple sublayer scaling rule defines an infinite family of Rs and stratification parameters on which the localized eigensolution is invariant.

45779 **Optimization of dish solar collectors.** Jaffe, L.D. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California). *Journal of Energy;* 7: No. 6, 684-694(Nov 1983).

Methods are presented for calculating and optimizing the performance of parabolic dish solar collectors and for optimizing their cost/output ratio. The effect of other portions of the solar power system upon collector optimization is considered. Examples are given, for several illustrative systems, of the results of variations in concentrator optical surface slope, specularity, and pointing errors; receiver aperture size, absorptance, and temperature; use of receiver windows and secondary concentrators; and engine type. Tradeoffs between collector efficiency and collector price are examined, as well as the effects of receiver temperature and collector size upon cost/output ratio. The most important performance optimization is that of the receiver aperature. The efficiency maxima associated with focal length and, if a heat engine is used, with receiver temperature, are relatively broad; it may be desirable to design somewhat off these maxima. Performance optimization is sensitive to slope and specularity errors of the concentrator. Performance may sometimes be improved by use of a secondary concentrator or a receiver window if the errors of the primary concentrator are large or the receiver temperature is high. Both collector efficiency and collector cost have strong effects upon the cost of the energy produced.

1420 Heat Storage

REFER ALSO TO CITATION(S) 14200046039

45780 **(SERI/TP—252-2359) Thermal energy storage at 900°C.** Copeland, R.J.; West, R.E.; Kreith, F. (Solar Energy Research Inst., Golden, CO (USA)). May 1984. Contract AC02-83CH10093. 7p. (CONF-840804—30). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84004589.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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This paper presents a preliminary technical and economic analysis of various concepts for sensible heat storage at a temperature of 900°C.

15 GEOTHERMAL ENERGY

1501 Resource Status And Assessment

REFER ALSO TO CITATION(S) 15010045810

45781 **(EUR—8853-EN) European geothermal update.** (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 787p. (CONF-8311132—). Commission of the European Communities, Luxembourg.

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The third international Seminar "European Geothermal Update" is centered on the results of the second R and D programme on geothermal energy and on selected demonstration projects, funded by the Commission of the European Communites. The results of the research contracts are subject of the volume. The search for geothermal resources is progressing well in all Member States. This volume informs on the reports of the eight sessions with following topics: - Resource exploration and evaluation; - processes, economics, environmental influences; - demonstration projects; - geochemistry; - drilling-productions; - reservoir engineering, downhole instrumentation; - geophysical exploration; - Hot Dry Rock. For each of the 84 reports a separate subject analysis has been carried out.

45782 **(EUR—8853-EN, pp 32-41) Estimate of the accessible resource base for the United Kingdom.** Rollin, K.E. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

An estimate of the accessible geothermal resource base has been made for onshore UK over a grid of mesh size 100^2 km. A three-layer temperature dependent conductivity model has been used in conjunction with a new heat flow map. The predominant geological formation in each grid element has been related to a dataset of physical properties and a matrix of heat flow values to calculate subsurface temperatures at three depths. The effects of low conductivity Westphalian and Mesozoic sediments have been partly included. From the grid values national maps of subsurface temperatures and heat stores have been produced. The temperature at 7 km depth varies between about 100 deg C in Central England which has low heat flow and conductive basement to about 250 deg C in SW England over the radioactive granites. The accessible resource shows a parallel variation between about 6 and 30×10^7 TJ per 100 km^2 with a mean value of about 12×10^7 TJ.

45783 **(EUR—8853-EN, pp 52-61) Evaluation of geothermal energy resources and reserves in selected areas of the Federal Republic of Germany.** Koppe, I.; Kleefeldt, M.; Haenel, R. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

In the area of the Federal Republic of Germany, assessment of the geothermal energy supply is restricted to selected aquifers within the large geological and morphological units of the Northwest German Basin, the Upper Rhine Graben and the Alpine Foredeep. To assess the geothermal resources and reserves, it is necessary to obtain the following aquifer parameters: depth, thickness, temperature, porosity, permeability and chemistry. The assessment has been carried out according to the guidelines set out by the Commission of the European Community. One example is taken from the Alpine Foredeep to illustrate the method of conversion of hydrogeological data into geothermal resources and reserves, expressed in amount of energy per unit aquifer surface.

45784 (EUR—8853-EN, pp 147-166) **Evaluation of the geothermal potential of the tertiary of Northern Greece.** Ten Dam, A.; Rouviere, J. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

An evaluation of the geothermal potential of the tertiary basins of Northern Greece was carried out in 1981-1982, on the basis of the data available on 33 deep oil exploration boreholes, against the background of the various thermal surface manifestations around these basins. The result of this evaluation is, that there are sufficient data for a tentative outline of objectives in the central part of the Thessaloniki basin, where temperatures appear to be of interest for domestic heating, but where there still is a lack of pertinent reservoir data.

45785 (EUR—8853-EN, pp 167-170) **Evaluation of the low enthalpy geothermal potential of neogene grabens of Northern Greece.** Berthier, F.; Fabris, H.; Tournaye, D.; Korotchansky; Riviere; Ten Dam, A.; Aronis, C.; Fitikas, M.; Pantasis, M.; Polychronidis, M. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The objective of the investigation were eight intracratonic grabens, mostly Mio-Pliocene age, stretch over northern Greece, from West (Adriatic sea) to East (Turkish border), namely: Grevena, Aridea, Thessaloniki, Strymon, Philippi-Drama, Nestos, Xanthi-Komotini, Alexandroupolis-Orestias.

45786 (EUR—8853-EN, pp 193-200) **Cost modelling of low enthalpy geothermal developments - U.K. costs.** Harrison, R. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Using the cost model which has been developed at Sunderland well head unit costs of geothermal heat are estimated assuming that drilling is carried out in the U.K. by the indigenous drilling industry. The sensitivity of unit costs to important reservoir parameters is investigated as also is the importance of "matching" the fluid parameters of temperature and flow with scheme demand and operating temperature characteristics.

45787 (NP—4770403) **Contributions on the subject: the geothermal situation in Switzerland.** Bodmer, H.P. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). 1982. 275p. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE84770403.

Subject of the thesis: the geothermal situation in Switzerland limited regionally and where research depth is concerned to those deposits which can be exploited in short or medium range. This applies to the northern foothills of the Alps (central region, Jura mountains, Valley of the Upper Rhine) - Southern End and some Alp valleys (thermal waters). The following subjects are dealt with as well: determination of the density of the heat flow, mapping of thermal water systems based on their geochemical or physical properties, methods and strategies of exploration. The last chapter is dedicated to estimates on the geothermal potential of Switzerland.

45788 (NP—4770405) **Second program energy research and energy technology. Vol. 1.** (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Energieforschung). 1984. 503p. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number DE84770405.

After a short introduction of the subject, the reports on the state of 32 research projects are reproduced. The reports contained in Volume I are subdivided into the two sections of "Geothermal energy" and "Seismology, hardware and software development". Individual abstract have been made for all projects.

45789 (NP—4770405, pp 39-50) **Assessment of geothermal energy stocks by means of selected examples in the Federal Republic of Germany.** Kleefeldt, M.; Koppe, I.; Haenel, R. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

Geothermal energy reserves are assessed in a joint project within the European Communities. It is planned for the FRG to establish the energy reserves for the aquifers of the large geologic-morphologic unit of the Northwest German Basin, the Muensterland Depression, the Lower Rhine Depression, the Upper Rhine Rift, the Swabian Alb mountains and the South German Molasse Basin. The new terms introduced to geothermics are explained by means of the McKelvey diagram. Special interest lies with those resources which represent that proportion of energy to be utilized economically in the near future, and with those reserves which can be exploited economically even today. Exemplified by the North German basin, the present state of investigation is demonstrated.

45790 (NP—4770405, pp 61-68) **Geopressured aquifers - utilization of the energy potential of the Endorf thermal water deposit.** Mueller, S.; Hantelmann, G. v. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

The Endorf thermal water deposit (Rupel, 4229 to 4264 m) belongs to the type of "geopressured aquifers". The overall aim of the project is to exploit the energy stored in the deposit in the form of thermal brine (temperature: 115°C) and natural gas (96% methane). In this first report on the project state, an overview on prehistory is followed by a description of the currently implemented test programme and its subsequent evaluation which aim at obtaining more exact knowledge concerning the present deposit conditions and, while doing so, indications of the energy content of the deposit in order to determine the energy potential theoretically exploitable at the well head.

1502 Geology And Hydrology Of Geothermal Systems

REFER ALSO TO CITATION(S) 15020045787, 45812, 45813, 45814, 45839, 45859, 45860, 45886

45791 (CONF-8203178—, pp 30-32) **Possibilities to obtain and to use geothermal energy in the Flachgau near Salzburg.** Zoetl, J.; Goldbrunner, J.; Zojer, H. Jul 1982. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number TI84770366.

From 10. Salzburg economic inquiry; Salzburg, Austria (4 Mar 1982).

The author presents a short survey of the hydrogeologic and lithologic setting of the Flachgau in Austria and affirms it to be applicable for geothermal exploration. Exploratory geothermal wells have not yet been drilled by comparable and near geologic and oil exploratory drillings revealed the Flachgau to be appropriate for geothermal use. Geothermal heat could be used in agriculture for heating greenhouses or soil.

45792 (CONF-8203178—, pp 33-37) **Study about the applicability of geothermal energy in the urban area of Salzburg.** Kroell, A.; Wessely, G. Jul 1982. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number TI84770366.

From 10. Salzburg economic inquiry; Salzburg, Austria (4 Mar 1982).

The hydrogeologic and geologic availability and risks of geothermal energy withdrawal in the urban area of Salzburg, Austria are assessed. Two sites follow from these prerequesitions: 1. Dolomite stratum, drilling depth 2-3 km, good chance to find a sufficient quantity and quality of water but of low temperature level (50-70°C). 2. Sediment stratum, drilling depth about 5000 km, risks about water quantity and quality but high temperature level (150°C). Economy of utilization of geothermal heat is considered in general.

45793 (EUR—8853-EN, pp 9-10) **Synthesis on 'low enthalpy' geothermal resources in France.** Maget, P. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Two types of aquifers, continuous and discontinuous aquifers are described. A map presents this classification of geothermal resources in France.

45794 (EUR—8853-EN, pp 11-21) **Geothermal energy programme of the Institute of Geological Sciences.** Downing, R.A.; Gray, D.A. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The objective of the programme is to investigate the geothermal potential of the UK. Studies are being made of the low enthalpy potential of aquifers in deep sedimentary basins and the HDR potential particularly of selected Caledonian granites. The main emphasis of the low enthalpy programme is placed on studies of Mesozoic and Upper Palaeozoic basins. These are supplemented by investigations in deep exploratory boreholes for oil and mineral resources and by drilling boreholes about 300 m deep to assess conditions relevant to geothermal exploration wells have been drilled. The HDR programme is concerned with measuring the heat flow from selected crystalline intrusive bodies with high heat production and large sub-surface volumes.

45795 (EUR—8853-EN, pp 106-110) **Study of the geothermal potential of the Mediterranean coastal regions of France between Perpignan and Marseille.** Godard, J.M.; Benoist, P.E. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The brief summary of the results of this inventory clearly show that geothermal resources of the coastline of South-Eastern France are highly varied. The geological history of this regions, which is especially marked by the immersion of the isthmus of the Durance, and by the uplift of the Pyrenees first of all, and then of the Alps, has resulted in considerable sedimentary and structural complexity. The reservoirs in this area consequently have extensions, depth, thickness, facies and geothermal potential, which varies very widely from one point to another. In spite of this, the synthesis study made provides a precise definition of the geothermal objectives vertically from a given region. The maps in the atlas make possible a preliminary approach to the geothermal potential of the sub-strata, where an energy consuming centre is likely to benefit from geothermal energy.

45796 (EUR—8853-EN, pp 171-173) **Geothermal exploration in the Island of Nisyros, Dodecanese, Greece.** Marinelli, G.; Marini, L.; Merla, A.; Sini, R.; Ungemach, P. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The Nisyros high enthalpy geothermal prospect has been selected on the following grounds: his location on the Aegeaen active volcanic Island Arc as a relevant geodynamic context; his association of volcano-tectonic and structural attributes and the possibilities of technical and economical development. The geological situation of Nisyros and the results of the investigations were described.

45797 (EUR—8853-EN, pp 174-179) **Preliminary geologic and geochemical data for the evaluation of geothermal potential in Sardinia.** Fanfani, L.; Pecorini, G. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

In order to evaluate the geothermal potential, Sardinia was divided in areas geologically homogenous, each of them exhibiting thermal waters with similar hydrogeochemical characters. On this basis we recognized five principal areas indicated as Casteldoria, Logudoro, Fordongianus, Campidano and Sulcis. The first and the last ones were previously partly studied for geothermal purposes so that the researches supported by the Commission of the European Communities concern the other three areas; up to today we consider as nearly performed the investigations in Campidano which revealed that an hypothetic thermal reservoir can be located only at considerable depth (>= 2.5 km) while the estimated temperature is about 110°C. Geologic and hydrogeologic studies in Logudoro are in progress with the aim of evaluating the geothermal parameters of an hypothetical aquifer in the Mesozoic carbonate formations at depth of 1-1.5 kilometers.

45798 (EUR—8853-EN, pp 182-192) **Study of thermal gradients in multilayer thermal systems, in sedimentary basins: Influence of the importance of cap-rock areas and of the reservoir capacity.** Alezine, T.; Cazal, A.; Gombert, P.; Gottis, M.; La Goutte, I.; Lefort, G.; Pelissier-Hermitte, G.; Pouchan, P. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Hydrological and geothermal research-works, in the last few years have provided a good number of hydraulic and thermal data about the underground in the Bordeaux area down to depth of 1000 m. Four main aquifer layers separated by impermeable layers constitute a multi layer system in Gironde. This system provides the concrete data for this study. There is deep anomaly in temperature, very precisely located in the ceremonian layer about 1000 metres deep. The influence of this anomaly on aquifers situated just above the ceremonian layer is examinated. Research-works, still in progress, examine the influence of hydrological factors (such as flow velocity, leakage, etc...) that may explain the location of the thermal data collected during the course of this research.

45799 (EUR—8853-EN, pp 313-323) **Results of drilling exploration in the Latera geothermal area: Utilization project of a water-dominated reservoir.** Barelli, A.; Corsi, R.; D'Offizi, S.; Lovari, F.; Manetti, G.; Rossi, U. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The drilling data from wells L3, L3D and L4 (project partially funded by the EEC, contract n.GE29/80), sited in the Latera area, Northern Latium, together with data from existing wells, have led to the construction of a geological model of the geothermal reservoir. Production and reinjection tests in wells L2 and L1 indicated that the geothermal fluid at Latera provokes calcium carbonate scaling in the boreholes and utilization plants. A development programme was thus launched along the following lines: 1st phase - prolonged production and reinjection tests, using scaling inhibitors on the surface and at well-bottom. 2nd phase - installation of a 4.5 MW back-pressure pilot plant; reinjection test under separator temperature and pressure conditions. 3rd phase - installation of a permanent condensing power plant.

45800 (EUR—8853-EN, pp 324-340) **High enthalpy geothermal exploration and development in Milos island in Greece.** Ninios, P.J. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The island of Milos in the Cyklades island group is situated on the volcanic arc of the southern Aegean sea. Geological, geophysical, geochemical and thermal gradient surveys proved the existence of very favorable conditions. The drilling of two exploratory wells confirmed the existence of a liquid dominated hot enthalpy reservoir. Then three production wells were drilled. All three were successfull. The works programmed for the immediate future are the installation of a 2 MW pilot plant, followed by 60 MW Power plant construction with parallel drilling of 15 wells and laying of off-shore and on-shore cables for power transmission to other islands and the mainland.

45801 (EUR—8853-EN, pp 430-438) **Geochemistry and geothermal potential of the warm springs of Munster, Ireland.** Brueck, P.M.; Cooper, C.E.; Duggan, K.; Goold, L.; Wright, D.J. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

A survey of spring waters in Munster, Ireland has so far located three spring complexes with waters significantly warmer than the ambient groundwater temperature. These are situated at Mallow and Kilmallock in Co. Cork and Newcastle West in Co. Limerick. At each spring complex the physical parameters (temperature, discharge, conductivity and pH) have been monitored weekly and chemical parameters monitored monthly. In addition the waters were analysed for stable isotopes, tritium and inert gases. These studies have allowed estimation of the original aquifer temperatures and degrees of groundwater contamination. Geological and geophysical surveys of the warm spring sites have facilitated modelling of the origin of the thermal waters. With this detailed knowledge of the characteristics of the warm springs it should now be possible to assess their potential as sources of geothermal energy.

45802 (EUR—8853-EN, pp 455-456) **Geothermal exploration in Monti Cimini permit, North Latinum, Italy.** Borghetti, G.; Sbrana, A.; Sollevanti, F.; La Torre, P. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

A geological survey of the area Monte Cimini is given. Located around the Lake Vico it is covered by the eruption products of the Quarternary volcanoes Vico and Cimino. Because of geophysical surveys and the geological situation a geothermal exploration is planned. A first exploratory well will be drilled in the Vico volcan system in the second half of 1983.

45803 (EUR—8853-EN, pp 457-466) **First exploratory well in the Sabatini area (Northern Latium).** Calamai, A.; Fiordelisi, A.; Pandeli, E.; Valenti, P. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Well SH 2 was drilled north of Bracciano Lake (Latium). This borehole was originally programmed as a "slim hole" to monitor the stratigraphic-structural and thermal conditions of the deep formations. Because of the high temperature conditions encountered during drilling, the decision was then taken to modify the original programme so as to prepare it for the eventual production of geothermal fluid. The article informs on the exploratory well especially as follows: the allochthonous flysch facies complex; the thermometamorphic-metasomatic complex; the logs as temperature measurements, thermal conductivity and heat flow; absorption and reinjection tests.

45804 (EUR—8853-EN, pp 467-476) **Nisiros 1 geothermal well.** Koutroupis, N. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Nisiros belongs to the Aegian active volcanic island arc. In recent years surface exploration including detailed geovolcanalogy and petrology, geochemistry, geophysics and shallow gradient holes were carried out in Nisiros which appeared as a promissing prospect. On the basis of the results obtained by the above extensive exploration, PPC decided in late 1981 the drilling of the first "wildcat" geothermal well in Nisiros. This first deep exploratory well confirmed the existence of an excellent geothermal field in this island. In fact a very important thermal anomaly (350°C at 1550 m) is present; moreover several permeable horizons were encountered and tests performed on the deeper of these aquifers, demonstrated the presence of economically exploitable high enthalpy fluids.

45805 (EUR—8853-EN, pp 116-121) **Study of possible exploitation of thermal water from Le Hainaut.** Beckelynck, J.; Bosch, B.; Desplan, A.; Dupas, J.; Leplat, J.; Talbot, A. 1984. (In French.). Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The tectonic structure of the Honiller basin is reviewed, and the geothermal potential of the karstified limestone strata of the Carboniferous is analyzed. The unique nature of this geothermal reservoir is illustrated by analyses of water samples from these strata. The energy demand of the region is briefly discussed.

45806 (EUR—8853-EN, pp 543-551) **Using down hole temperature survey to adjust a simplified model for heat transfer inside a well.** Ferey, J.P.; Tressol, J.L. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Accurate downhole temperatures are required for a simulation model of heat transfer between the well and the drilled strata. A suitable measuring tool is described. Preliminary measurements using this tool are mentioned. Simplified conditions were assumed for the simulation of heat transfer which lead to an analytical solution of the heat transfer equations. Final results are not available as the study is still in progress.

45807 (LBL—15500, pp 207-253) **Mexican-American Cooperative Program, Cerro Prieto.** Sep 1983. NTIS, PC A13/MF A01. File Number TI84003916. Contract AC03-76SF00098.

In Earth Sciences Division annual report, 1982.

Mexican-American Cooperative Program, Cerro Prieto Summaries are included which focus upon developing an understanding of the Cerro Prieto geothermal field by analyzing all available data to determine the evolution of the geothermal systems. Research topics include fluid flow modeling, resistivity modeling with waters of different salinities, dipole-dipole resistivity monitoring, seismological studies, precision gravity and subsidence measurements, analysis of the Nuevo Leon magnetic anomaly and its possible relation to the Cerro Prieto system, production characteristics of wells, and prediction of reinjection effects.

45808 **US Department of Energy research and development programs in geothermal energy.** Lombard, D. (Dept. of Energy, Washington, DC). pp 189-202 of Fourth annual energy seminar. Erie, PA; Gannon University (1982). (CONF-8203126—).

From 4. annual energy seminar; Erie, PA, USA (23 Mar 1982).

Geothermal energy is classified into three different resource categories: hydrothermal, geopressured, and hot dry rock. The relevant physical and geological characteristics of each resource type are discussed, as well as the difficulties that inhibit exploitation. An overview of DOE's geothermal research and development programs is presented. For high temperature hydrothermal resources, the industry is beginning to be quite active. However, much research and development is needed to provide the technlogy to convert these resources to a point where industry can exploit full potential.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 15030045781, 45787, 45787, 45787, 45788, 45791, 45792, 45794, 45795, 45797, 45798, 45799, 45800, 45801, 45802, 45803, 45804, 45806, 45882, 45894, 45901, 46771

45809 (DOE/ET/28393—T3) **Geothermal assessment of part of the east shore area, Davis and Weber Counties, Utah.** Klauk, R.H.; Prawl, C.A. (Utah Geological and Mineral Survey, Salt Lake City (USA)). Jul 1984. Contract AS07-77ET28393. 95p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84016817.

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Geothermal reconnaissance techniques attempted in this study included a water temperature survey, and chemical analyses of springs and wells. The temperature survey identified 12 wells with water temperatures 20°C or higher. These wells were, however, located throughout the study area and with the exception of one location (W-15), exhibited no other low-temperature thermal characteristics that indicated warmer temperatures could be expected at depth or within the vicinity. Sample location W-15 was similar, chemically, to Hooper and Ogden Hot Springs as well as samples

collected from three other non-thermal wells in the area. Although these three samples had temperatures that only ranged from 14° to 16°C, chemical geothermometer results indicate temperatures to be expected at depth range from 60° to 90°C. Other chemical characteristics of these samples indicative of low-temperature geothermal potential not previously identified include common ion concentrations high in Na and Cl, high concentrations of trace elements such as Li, Ba, and Sr, as well as Ca/HCO_3 and Cl/B ratios greater than background.

45810 **(DOE/ET/28393—T4) Geothermal assessment of the lower Bear River drainage and northern East Shore ground-water areas, Box Elder County, Utah.** Klauk, R.H.; Budding, K.E. (Utah Geological and Mineral Survey, Salt Lake City (USA)). Jul 1984. Contract AS07-77ET28393. 98p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017358.

Portions are illegible in microfiche products; Report of Investigation No. 186.

The Utah Geological and Mineral Survey (UGMS) has been researching the low-temperature geothermal resource potential in Utah. This report, part of an area-wide geothermal research program along the Wasatch Front, concerns the study conducted in the lower Bear River drainage and northern East Shore groundwater areas in Box Elder County, Utah. The primary purpose of the study is to identify new areas of geothermal resource potential. There are seven known low-temperature geothermal areas in this part of Box Elder County. Geothermal reconnaissance techniques used in the study include a temperature survey, chemical analysis of well and spring waters, and temperature-depth measurements in accessible wells. The geothermal reconnaissance techniques identified three areas which need further evaluation of their low-temperature geothermal resource potential. Area 1 is located in the area surrounding Little Mountain, area 2 is west and southwest of Plymouth, and area 3 is west and south of the Cutler Dam. 5 figures, 4 tables.

45811 **(DOE/ET/28393—T5) Evaluation of low-temperature geothermal potential in Utah and Goshen Valleys and adjacent areas, Utah. Part I. Gravity survey.** Davis, D.A.; Cook, K.L. (Utah Geological and Mineral Survey, Salt Lake City (USA)). Apr 1983. Contract AS07-77ET28393. 169p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE84017359.

Portions are illegible in microfiche products; Report of Investigation No. 179.

During 1980 and 1981 a total of 569 new gravity stations were taken in Utah and Goshen Valleys and adjacent areas, Utah. The new stations were combined with 530 other gravity stations taken in previous surveys which resulted in a compilation of 1099 stations which were used in this study. The additional surveys were undertaken to assist in the evaluation of the area for the possible development of geothermal resources by providing an interpreted structural framework by delineating faults, structural trends, intrusions, thickness of valley fill, and increased density of host rock. The gravity data are presented as (1) a complete Bouguer gravity anomaly map with a 2 mgal contour interval on a scale of 1:100,000 and (2) five generally east-trending gravity profiles. A geologic interpretation of the study area was made from the gravity map and from the interpretive geologic cross sections which were modeled along the gravity profiles.

45812 (EUR—8853-EN, pp 22-31) **Geothermal resources of Eastern England.** Gale, I.N.; Holliday, D.W. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Work on the geothermal potential of the Carboniferous, Permian and Triassic rocks of eastern England is summarised. The most favourable areas are to be found close to the coast where significant quantities of water at c. 40°C are predicted in the Triassic Sherwood Sandstone and smaller amounts at c. 60°C from the Lower Permian Sands. Despite the great thickness of Carboniferous rocks, they do not contain a geothermal resource unless it can be exploited by the "hot dry rock" method.

45813 (EUR—8853-EN, pp 42-51) **Contribution to the knowledge of the geothermal conditions in Italy.** 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The studies to be carried out under this contract are not yet completed. Preliminary information is given on the most progressed works consisting of the construction of specific maps, covering the whole Italian territory, which will be incorporated in the Map of Europe. These maps are: Main Aquifer Map, intended as the contouring of top of the basal carbonate aquifer, Temperature Maps for depths of 1,000 m, 2,000 m and 3,000 m below ground level, Heat Flow Map, Springs and Baths Map. The information given is mainly statistical in nature and refers to the sources of information and to the quantity, quality and areal distribution of the data, with the addition of a short comment on the basic approach and methodology followed in the map construction.

45814 (EUR—8853-EN, pp 62-72) **Lateral heat flow differences in the Rhinegraben area.** Sattel, G.; Ott, W.; Fuchs, K. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The Rhinegraben is a zone of high heat-flow density. Some special areas like the Sultz or the Landau oilfields have extremely high heat flows and it was the task of a joint EG-Project in Geothermics (TU Berlin and University of Karlsruhe) to estimate the extension of these extreme heat-flow anomalies in the Rhinegraben. Therefore, from the University of Karlsruhe a lot of temperature profilings and in-situ determinations of thermal conductivity were carried out in an area of 50x70 km^2 with its center-line between Landau and Bruchsal. Although the number of deep oil wells in the area was not sufficient, it was possible to use about 80 water observation wells more or less homogeneously spread over the observation area. The first result of these measurements is, that the zone of high heat flow is not symmetric with respect to the graben axis, its center lies in the thermal anomaly of the Landau oilfield and spreads towards the river Rhine. Another preliminary result is that the maximum heat-flow differences in the Rhinegraben area are about 70 mW/m^2. The maximum value of heat-flow density is about 130 mW/m^2 in the Landau oilfield and the minimum value of about 60 mW/m^2 is found South of Karlsruhe.

45815 (EUR—8853-EN, pp 73-83) **Determination of terrestrial heat flow in shallow drill holes of the northern Upper Rhine Valley.** Behrens, J.; Villinger, H.; Clauser, C. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

In an attempt to utilize shallow drill holes for the determination of the terrestrial heat flow density over 90 such boreholes were logged for temperature profiles in the northern Upper Rhine Valley. 40% of these profiles show no or little distortions, another 40% exhibit distortions typical of predominantly vertical water flows, and the rest is otherwise distorted. For the determination of the in-situ thermal conductivity in cased boreholes a new method has been developed using the temperature rise of a heated section of the waterfilled boreholes. Since most of the measurements are more or less disturbed due to induced convection within the annular space, the measurements permit only an estimation of the thermal conductivity. To avoid this a number of technical improvements are possible and are being discussed.

45816 (EUR—8853-EN, pp 84-94) **Geothermal reservoirs in Denmark.** Priisholm, S. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The possibilities of low enthalphy energy sources in Denmark has been investigated. Particular emphasis has been placed on the reservoir characteristics with the intent if possible to produce synthetic reservoir assessments. The investigations of the reservoirs have included the establishment of sedimentary environment,

degree and type of diagenesis, temperature mapping, factors controling formation brine salinity, the decrease of porosity with increased depth of burial and the relationships between porosity and permeability. Very simplified the porosity of the reservoirs decrease from 30-40% at 500 m depth to 5-15% at about 3500 m depth. The significant decrease in permeability with increased depth is noted. Temperatures increase from about 55-75°C at 2000 m to 75-105°C at 3000 m depth. Temperatures of 100-150°C are reached in the central part of the sedimentary basins.

45817 (EUR—8853-EN, pp 95-104) **Subsurface temperature field in Denmark.** Balling, N.; Nielsen, S.B.; Rooy, D. van; Saxov, S. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Danish subsurface temperature distribution data originate from two sources: borehole temperature measurements taken during and after drilling, and theoretically modelled values. BHT data and results from new precision temperature logging in shallow and deep boreholes are applied. The model temperatures are calculated from analytical and numerical solutions of the heat equation and based on measured parameters for heat flow, thermal conductivity, and heat production. The results define the general temperature pattern of the sedimentary basins. Significant lateral variations are observed; at depths from 2000 m to 3000 m temperatures vary laterally at any depth by about 25°C, generally with an increasing variation with depth. Regional temperature variations and local anomalies are produced by thermal conductivity and heat flow variations. Main geothermal reservoirs of variable depth have temperatures ranging from about 40°C to about 100°C.

45818 (EUR—8853-EN, pp 105) **Geothermal potential of deep-lying, low enthalpy aquifers in the Netherlands.** Milius, G.; Montfrans, H.M. van; Prins, S.; Rooyen, P. van. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The aim of the project described here is to ascertain the geothermal potential of deep-lying aquifers in The Netherlands. To this end an inventory of relevant data has been assembled.

45819 (EUR—8853-EN, pp 122-133) **Analysis of reflection seismic data for the detection of karstified limestones at depth.** Vandenberghe, N.; Poggiagliolmi, E.; Schwarz, E. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Surface seismic data are analysed to develop a methodology which shows the influence of dissolution and fissure porosity in limestones. The karstified limestones studied are the Lower Carboniferous limestones at depths between 1500 and 2500 m in North-Belgium. The reflection characteristics at the contact of the Namurian shale and the karstified Dinantian limestone are indicative of the karst density. The Poisson's ratio of the limestone varies with its karst density. At large offsets, variations in Poisson's ratio result in reflection magnitude variations at the shale-limestone contact. Indeed, offset variant displays for the same line interval show a different continuity of the top limestone reflector. Borehole calibration is required to establish a precise relationship between karst density and offset dependent reflection magnitude.

45820 (EUR—8853-EN, pp 134-138) **Seismic research for karstification zones in the Visean limestone on the northern flank of the Brabant Massiv.** Helbig, K. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The mapping of the Visean limestone was undertaken with the seismic method. There were some expectations that karstification could be deduced from the seismic data, either directly on the basis of diffraction hyperbolae or indirectly by a change in amplitude and/or frequency content. A vibroseis crew of Prakla-Seismos was used for data acquisition, data processing was going to be done by Prakla-Seismos and Entec, interpretation was scheduled to be done by all participants.

45821 (EUR—8853-EN, pp 139-142) **Comparative gravimetric and magnetometric investigations in and near the Central Graben (Roervalleygraben) in the Province of Limburg.** Bredewout, J.W. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

A gravimetric and a magnetometric survey were performed in Central-Limburg and the surrounding area in the south-eastern part of The Netherlands.

45822 (EUR—8853-EN, pp 143-146) **Heat flow pattern of Greece.** Kolios, N.; Taktikos, S.; Fytikas, M. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

A preliminary map of the Greece's heat flow was compiled in 1977. It was based on a small number of measurements irregularly distributed on marine and land areas. The PPC (Public Petroleum Corporation) temperature logs and the bibliography were mainly used for the measurements of the map and some measurements were effected by I.G.M.E. As the thermal conductivity measurements these were taken from tables after having studied the corresponding lithological columns. For having the heat flow values on the sea-bottom we have used relative bibliography. After Greece's accession to the EEC and the signature of the relative contract between the EEC and I.G.M.E. (contract EG-Al-047-G) great efforts have been made towards the compilation of Heat Flow and underground temperature maps, being now based on measurements, carried out by I.G.M.E., and also on the PPC data. The bibliography data of submarine measurements will of course be taken into consideration. The results of the Greece's heat flow values indicate areas of comparatively high values, especially, along the active volcanic arc of Southern Aegean, within the Central Aegean Sea (back arc area), along the Northern Aegean trench, in areas of active continental grabens such as Thessaly, Macedonia and Thrace. On the contrary, the values of heat flow and the underground temperatures are comparatively low in the Ionian Sea and the Western Continental Greece.

45823 (EUR—8853-EN, pp 180-181) **Incidence of structural pattern upon distribution of isotherms in sedimentary basins.** Berthier, F. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Pricise knowledge of temperature parameter is with flowrate, of first importance for every geothermal purpose: technico-economic feasibility of projects, evaluations of regional geothermal power, incipient thermomineral phenomenos. Temperature versus depth, i.e. gradients, materialize the overall and steady state equilibrium of heat transfer through rocks of different thermal conductivities; this involve heat supply from deeper parts and consecutive heat losses toward the surface. Recent geothermal well drilled in "well-referenced gradient" areas revealed anomalies that couldn't be suspected till now. In such cases, and depending on the proper structural context, many factors are invoked as: lateral changes in conductivities, convective transfer of heat by aquifers, fault and fold patterns, basement conductivities, radioactive heat supply. The aim of this contact, was to define in what way (kind, magnitude) the known structural anisotropies can provoke noteworthy variations in steady state isotherms with special reference and applications to French case-types.

45824 (EUR—8853-EN, pp 232-240) **Survey of local seismic activity during production and reinjection of geothermal fluids in Cesano and Latera areas.** Cameli, G.M.; Fiordelisi, A.; Carabelli, E.; Graciano, F. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The European Economic Community has assigned to Enel and Ismes the monitoring of any seismic activity eventually induced by production and reinjection of geothermal fluids in the Cesano area (30 Km north of Rome). The objective of the survey is to define the local parameters, and the source characteristics of the events. Integration of the existing permanent network with another network of high instrumental potential positioned around the reinjection well produced such an accurate control and study system that no event, even of extremely low magnitude, could have escaped detection during operations. Throughout the long observation periods no seismic event was monitored that could be correlated with the operations. For this reason, and in order to provide data on induced events, the decision was taken, with EEC approval, to conduct a similar experiment in the Latera geothermal field (30 Km NW of Viterbo). During a short reinjection test an interesting microseismic event was monitored that could clearly be related to this test.

45825 (EUR—8853-EN, pp 262-274) **Western esplanade geothermal project in Southampton, England.** Smith, M.D. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The Southampton Project is intended as the first U.K. demonstration of a Geothermal Heating Scheme. It is being jointly undertaken by the Southampton City Council and the Government's Department of Energy. Drilling commenced in September 1981 and a final depth of 1827 metres was reached in November. The Triassic Sandstones, the potential geothermal aquifer, were encountered between 1729 and 1796 metres. A 6 day gas lift test in December 1981 indicated an observed temperature at aquifer level of 72°C. A maximum flow rate of 30 litres/second was achieved for a pressure reduction of 4.2 MN/m². The results indicated a transmissivity of 7 to 8m²/day. In February 1983 a 30 day extended pumping trial was completed and at the time of writing the detailed results are awaited. If the results are favourable a district heating scheme will be constructed. The first connections being to the Civic Centre and Central Swimming Baths. In due course the whole of a new City Centre development will be connected to the scheme. The development will include offices, hotel and conference centre, sports and leisure complex, bus station and some shopping areas.

45826 (EUR—8853-EN, pp 282-286) **Ferrara geothermal project.** Carella, R.; Guglielminetti, M. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The Ferrara Geothermal Project originates from the discovery made by AGIP, in the Ferrara zone, of an interesting geothermal reservoir, able to supply thermal energy for heating civil, industrial, and agricultural utilities.

45827 (EUR—8853-EN, pp 295-302) **Outline on geothermal projects in Denmark.** Magtengaard, J.R. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The Danish geothermal exploration was started in 1977, and since then (up till April, 1983) approx. 115 mill. D.kr. have been spent on the activities. At present Dansk Olie and Naturgas A/S have to its disposal 5 geothermal exploration wells, all under evaluation. In this note you will find a brief summary of the course and status of the two projects most advanced, i.e. the Aars - and the Thisted projects.

45828 (EUR—8853-EN, pp 341-353) **San Pompeo 2 deep well: A high temperature and high pressure geothermal system.** Batini, F.; Bertini, B.; Bottai, A.; Burgassi, P.D.; Cappetti, G.; Gianelli, G.; Puxeddu, M. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

San Pompeo 2 well, located in the southern part of the Larderello geothermal field, was aimed to the production of geothermal fluids for electric generation from deep layers of the basement related to anomalous seismic horizons of brightspots type. Below the sedimentary cap rock and the presently exploited geothermal reservoir, the well crossed a thick sequence of metamorphic formations of Paleozoic age (phyllites and micaschists) affected by a widespread hydrothermal metamorphism. High temperature hydrothermal and contact metamorphism mineral assemblage prove the presence of a nearby apophysis of an Alpine granite intrusion. In-hole geophysical logs confirmed the existence of a deep seismic reflecting horizon which probably corresponds to fractured levels at bottom hole in the basement. Here a fluid with $T > 400°C$ and $P > 240$ bars was found.

45829 (EUR—8853-EN, pp 390-403) **Helium isotope tracers in geothermal systems: A study of the Larderello area.** Hooker, P.J.; O'Nions, R.K.; Oxburgh, E.R.; Bertrami, R.; Lombardi, S. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Helium dissolved in geothermal fluids and in ground waters has contributions from two main sources, each with a characteristic isotopic signature; He from the mantle has $^3He/^4He$ proportional 10^{-5} and has a significant primordial component while crustal He has $^3He/^4He$ proportional 10^{-6} and is generated by nuclear reactions and radioactive decay in the crust. Early work suggested that an enhanced component of mantle He was associated with high heat flow. The present study has examined this relationship and the other information to be derived from the isotopic composition of He in geothermal systems.

45830 (EUR—8853-EN, pp 406-414) **Geochemical evaluation during low enthalpy drilling and testing.** Edmunds, W.M.; Bath, A.H.; Miles, D.L.; Darling, W.G.; Andrews, J.N. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Experience gained during exploration and testing for low enthalpy geothermal resources in the United Kingdom has enabled a systematic geochemical procedure to be established for deriving the maximum information on reservoir conditions and the properties of production fluids. Methods have been established for extraction and analysis of interstitial waters derived from core material which enable reservoir conditions to be assessed during drilling and in advance of well completion. The merits and disadvantages of drill-stem testing, gas lift and production testing are compared using results derived during the Marchwood and Southampton (Western Esplanade) drilling and production programmes in the Triassic Sherwood Sandstone of the Wessex Basin, where successful recovery of brines (104 g/l and 124 g/l respectively) at temperatures in the range 72-76°C was achieved.

45831 (EUR—8853-EN, pp 415-424) **Geothermal energy investigations in Ireland.** Burdon, D.J.; Burns, D.J.; Peel, S. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The Project includes thermal logging of 39 boreholes, followed by interpretation of this data. Much of the work has been on the 17 warm springs of Leinster, their identification, and selection of 10 cold control springs. Air and water temperature measurements have totalled over 2,000 observations; electrical conductivity, pH, Eh, O_2, Cl and F have been measured regularly. Some 66 full chemical analyses have been made regularly on two large warm springs, and on some others. Intensive investigations were made on five ocacasions; there have been some test-pumping of two springs. The Geological Survey did some drilling on two springs, outside their obligations under the contract. This paper ends by selecting three aspects of the investigation for brief presentation. They are: (i) Thermal logging of boreholes; (ii) Relationship between hydrological and tidal discharges of Kilbrook spring; and (iii) Hydrochemistry of Louisa Bridge spring.

45832 (EUR—8853-EN, pp 425-429) **Equilibrium temperature and heat flow density measurements in Ireland.** Brock, A.; Barton, K.J. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Equilibrium temperature and heat flow density measurements have been made in Ireland in boreholes originally drilled for mineral exploration. The distribution of boreholes is controlled by exploration needs, and is confined almost entirely to the Carboniferous limestone. Gradient values from 27 holes measured with a thermistor probe together with further 6 BHT values reported by oil exploration companies show two areas in which higher than average gradients occur. These are in the Clare basin and the north west Carboniferous basin. Both are believed to be due mainly to lithologic factors. Currently ten equilibrium heat flow density values are available. They have an average value of 65 mWm^{-2}, but there is a suggestion that there is northwards increase of heat flow density across Ireland.

45833 (EUR—8853-EN, pp 439-450) **Low enthalpy drilling in Denmark.** Nielsen, B.L. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The Danish geothermal exploration was started in 1977. A preliminary feasibility study suggested a geothermal potential within five different formations and recommended exploration focussed on the 2000-3000 m depth interval. The reservoirs are all sandstones and to date three exploratory well have been drilled to a total depth of approximately 3000 m. Tests have shown economical marginal or too small transmissivities, and as a consequence of this the exploration is now concentrated on shallower reservoirs of lower temperature, but with much improved reservoir performance. A fourth well, Thisted-3, has recently been drilled to 1242 m. It is planned as the injection well for the Thisted geothermal demonstration plant, presently being constructed.

45834 (EUR—8853-EN, pp 451-452) **Deep exploration in the S. Vito area (Pozzuoli-Na).** Bruni, P.; Chelini, W.; Sbrana, A.; Verdiani, G. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Well S. Vito 1 is located in the S. Vito plain which represents a secondary collapse within the major and more ancient phlaegrean caldera. Geophysical and hydrogeochemical prospections detected an interesting thermal anomaly in this area. The objectives sought by the well were: 1 - exploration of the local lithostratigraphic series which was totally unknown because no other deep wells were ever drilled before in the area; 2 - investigation of the possible reservoirs; 3 - characterization of the chemical and thermal properties of the reservoir fluids.

45835 (EUR—8853-EN, pp 453-454) **Exploratory well in 'Ottaviano' permit, Italy.** Silvano, A.; Vaselli, M.; Verdiani, G. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

In order to assess the geothermal potential of the Vesuvius area volcanological and petrological studies has been carried out. The indicate a shallow magmatic chamber (2 km to 4 km depth) with a cylindrical volume of about 2-3 km^3 as a possible geothermal resource. A deep well was drilled to prove this assumption.

45836 (EUR—8853-EN, pp 525-534) **Report on experiment addressing reinjection of heat depleted brines in a clastic sedimentary reservoir in Acheres (Lower Triassic sandstones, Paris Basin).** Vathaire, J.C.; Du Chaffaut, B. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The sandstones of the Lower Triassic (Buntsandstein) represent a good geothermal target in the Paris Basin. The geothermal project Acheres (west of Paris) involves the heating of 2700 dwellings. The single steps of drilling and testing of the two exploratory wells are described. Another chapter concerns the reinjection testing.

45837 (EUR—8853-EN, pp 535-542) **Geothermal doublet of the Melleray Trias results of the well test performed on injection well GMY 2 in 1982.** 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The geothermal reservoir of Trias is located in Melleray at a depth of between 1400 and 1600 m. Two drillings, a production drilling and a reinjection drilling, were carried out. Difficulties concerned with these drillings are described.

45838 (EUR—8853-EN, pp 552-563) **Design and testing of downhole probes for operations in deep and hot environment.** Adorni, N.; Mezzetti, S.; Ceppatelli, L.; Ferrara, G.C.; Pizzolati, P.L. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The development of new instrumentation for geothermal borehole results in the creation of probes for measuring temperature and pressure, bore diameters, in-hole fluid velocity, and probes for isokinetics sampling at wellhead. The present contract has extended the range of instruments available and included a device for sampling fluid in the well, along with a probe for temperature measurements incorporating optical fibres capable of operating in temperatures up to 500°C. The innovation of this advanced instrumentation lies in the exploitation of the birefringence properties of a lithium nyobath crystal (Li NbO_3) as a temperature sensor, and of an optical fibre cable as surface vector the signals monitored in the sampling point.

45839 (EUR—8853-EN, pp 567-577) **Broadband tensorial magnetotelluric study in the Travale-Radicondoli geothermal field.** Hutton, V.R.S.; Dawes, G.J.K.; Devlin, T.; Roberts, R. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

As a contribution to the EEC study of the potential contribution of electric and electromagnetic techniques to geothermal exploration, magnetotelluric studies have been undertaken with sounding bandwidth ranging from 2 to 7 decades of period at more than 30 sites within the chosen test area of Travale. Although this area must be one of the most unfavourable for the application of electrical techniques on account both of the thickness (up to 2 km) of conducting (approx.= 3 ohm m) cover formations and of the intensity of the artificial disturbances from the power stations and distribution lines, it was possible to obtain good quality data by employing an automatic in-field analysis system and rigorous data analysis and to penetrate to reservoir depths at the centre of the graben by undertaking broadband (up to 10^4s) soundings at some sites.

45840 (EUR—8853-EN, pp 578-587) **Investigation of the geothermal anomaly of Travale/Tuscany by telluric, magnetotelluric and geomagnetic deep sounding measurements.** Berktold, A.J.; Dittus, H.J.; Eigner, K.H.; Teufel, U. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

As part of an European Community research programme telluric, magnetotelluric and geomagnetic deep sounding measurements were undertaken at 40 sites within the geothermal area of Travale. In the period range of 6-10000 s the telluric field inside the Era graben is strongly polarized and directed - independent of the period - about parallel to the graben strike. The lateral variation of the telluric field amplitude is determined mainly by the distribution of the rocks (e.g., the central part of the geothermal anomaly inside the graben is correlated with a horst structure of resistive rocks)

and an influence of the geothermal anomaly on the telluric field distribution cannot be observed.

45841 (EUR—8853-EN, pp 588-599) **Electrical conductivity studies in the Travale geothermal field, Italy.** Schwarz, G.; Haak, V.; Rath, V. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Magnetotelluric- and geomagnetic depth soundings have been carried out in the area of the Travale high enthalpy geothermal field - Central Tuscany, Italy - in the years 1980 and 1981 to study the distribution of electrical conductivity in the geothermal anomaly and the crust beneath. Within this project the possible contributions of electromagnetic investigations to geothermal research should be tested, a geothermal model of the Travale area was to be developed. The time-varying electric- and magnetic fields have been recorded in a broad period range from 6 - 10 000 s, mainly on two profiles, the one parallel, the other perpendicular to the Travale Graben. Strong lateral variations of apparent resistivities have been observed.

45842 (EUR—8853-EN, pp 600-608) **Magnetotelluric measurements at Travale.** 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Statements are made about the stratigraphic sequence and the tectonics of the area. In two phases (september 1980 and september 1981) 15 magnetotelluric soundings were performed. They follow two lines, perpendicular and parallel to the graben direction. The results are discussed.

45843 (EUR—8853-EN, pp 609-616) **Active audiomagnetotelluric application in geothermal areas.** Musmann, G.; Otten, J. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

It was the aim of this project to develop an active audiomagnetotelluric equipment for geothermal exploration of the upper 10 km. For this purpose a power audiofrequency generator (8 kW) for the frequency range 0-2 kHz was developed. This power is fed into the ground using an electric dipole of 300 m length. The receiving station (3 orthogonal induction coils and 2 electric field sensors) must have a distance of at least 5 times the dipole length and 3- to 5 times the skindepth for being located in the so-called far-field of an ideal dipole. Taking into account the natural and technical noise and the sensitivity of the equipment the maximum distance of the receiver can up to 20 km. The interpretation was done using Cagniard's theory and a near-field theory.

45844 (EUR—8853-EN, pp 617-626) **Differential magnetic sounding in the Travale-Radicondoli geothermal area.** Mosnier, J. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

In 1980 and in 1982, the Laboratory of Applied Geophysics of the C.N.R.S. attempted to establish by magnetic differential sounding a possible anomaly of conductivity, linked with the geothermal field of Travale - Radicondoli (Tuscany). Some 25 sites have been occupied along two profiles, one being located between Sienna and Populonia, near Piombino, the other one between Sienna and Cecina. An important anomaly of the transient magnetic field (some 15% of the normal field) was brought to light in 1980 between Gerfalco (in the S.W.) and Frosini (in the N.E.) It exactly covers the geothermal area of Travale. The direction of the telluric currents causing the anomaly is parallel to the magnetic meridian and their maximum depth is of some 2000 metres. The 1982 campaign has shown that in the North of Travale, anomalous currents move in the N.W. - S.E. direction or even completely E.W. (in the S.W. of Volterra), an meet in the sea, round Livorno. One can give an interpretation of the phenomena as a whole, if one admits the presence of very conductive layers between Lardello and Travale. The currents which circulate parallel to the coast are channelled locally by this structure which could be closely linked up with the vapor field.

45845 (EUR—8853-EN, pp 645-653) **Experimentation of various electric and electromagnetic methods on the geothermal field of Radicondoli - Travale (Italy).** Le Masne, D. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

A research on the application of several electric and electromagnetic methods to a geothermal field (Radiocondoli-Travale graben) has been undertaken by the B.R.G.M. The aim of the research was to refine the conceptual model of the Travale-field, and therefore to describe the morphology of the basement (down to 2 km depth) and of the rhetic reservoir covered by impermeable series. The best suited method for this type of prospection appeared to be the electrical dipole-dipole profiling combined to a two-dimensional interpretation. Contrasts at more than 2 km depths (500 m long dipoles) could be seen and compared to the depths measured in the boreholes. The E.M. Melos method (Syscal equipment) should be improved (decreasing in frequencies) to increase the depth penetration. It is however a good complementary method for the surface layers. A try of computational interpretation of Self Potential profiles is promising. Efforts should be devoted to computational interpretation of the bipole-dipole map to turn it to the best account.

45846 (EUR—8853-EN, pp 668-673) **P and S differential arrival times at a dense array: A marker of the Travale field from local earthquakes.** Hirn, A.; Ferrucci, F. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

In an approach different from seismic reflection surveying which mainly detects and traces the depth of interfaces between different layers, we do not use shots or vibrations at the surface, near to the receivers. We use sources outside the structure, natural earthquakes or shots at regional distance and the waves sent back by distant deep interfaces or local earthquakes at significant depth and their direct waves. The waves transmitted from beneath, through the structure to be studied, are recorded by a dense two-dimensional array of sensors.

45847 (EUR—8853-EN, pp 674-679) **Differential attenuation of seismic waves at a dense array: A marker of the Travale field from sources at regional distance.** Hirn, A.; Ferrucci, F. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Dense arrays of three-component tape-recording seismographs have been temporarily maintained in the Travale area for two periods of several weeks to record natural earthquakes and at one instance to record shots fired at sea. Very reduced station separation, of less than 1 km (20 stations on a 3 x 3 km^2 area) was meant at an investigation of the geothermal fields itself. The analysis of seismic attenuation presented uses particular data: from waves generated at distances of the order of 100 km and sent back to the array by deep crustal reflectors, thus ensuring the steep incidence favourable for horizontal resolution. Sources are in the North natural earthquakes from which in addition to P data a few S are obtained, and in the South shots at sea.

45848 (EUR—8853-EN, pp 680-691) **Geothermal reservoir study by means of combined P and S waves: Seismic reflection survey and velocity logs in the Travale-Radicondoli field.** Batini, F.; Nicolich, R. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Laboratory measurements and theoretical studies have demonstrated that P and S waves velocities depend on the type and amount of the saturating fluids in porous media under particular saturation, pressure and temperature conditions. V_S/V_P ratio has

been tentatively measured in geothermal fields by utilizing the reflection seismic velocities and passive seismological data. This study is devoted to the determination and evaluation of the potentiality of the geothermal reservoirs, and of the nature of the fluid content. The aim is to improve interpretative methodologies in geothermal areas, especially for the recognition of the structures of metamorphic-crystalline basement by means of seismic methods with high geometrical resolution and penetration. P and S waves behaviour has been measured by reflection seismic profiles and sonic logs.

45849 (EUR—8853-EN, pp 751-758) **Monitoring the background and induced seismicity for the Hot dry rock programme in Cornwall.** Turbitt, T.; Walker, A.B.; Browitt, C.W.A.; Morgan, S.N. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Fluid injection under high pressure into deep bore-holes has been observed to cause induced seismicity on a number of occasions. The Camborne School of Mines (CSM) project to create a geothermal reservoir in the Carnmenellis granite in Cornwall was expected to induce similar activity during the hydrofracture phase. CSM estimated the risk from an induced event by considering the intended volume of cracked rock and assumed stress drops. The risk implied from triggering a natural event was estimated by the Institute of Geological Sciences (IGS) by studying the records of historical activity in the area over the past few hundred years and by installing a network of seismographs to monitor the present day background seismicity. The network of telemetered seismometers installed 18 months before hydrofracture, detected, located and discriminated between natural earthquakes, explosions from mines, quarries and weapons tests, sonic booms and the induced events themselves. Some 11,000 injection-induced events were detected over a period of four months with magnitudes ranging up to 1.0 ML.

45850 (EUR—8853-EN, pp 759-766) **Shallow depth experimentation on a method for Hot Dry Rock geothermal energy recovery.** Cornet, F.H.; Jolivet, J.; Bernaudat, F.; Ledoux, E.; Mosnier, J. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The purpose of this shallow depth experimentation was threefold: - Identify by geophysical means, depth, dip and strike of natural fissures encountered in a 250 m deep borehole drilled in granite at Le Mayet de Montagne test site; - Chose a zone in the borehole where to generate hydraulically a fracture in a direction different from that of the in-situ major principal stress. This direction was to be such that the fracture intersects another one developed previously between two, 200 m deep, boreholes. - Test the thermal and hydraulic efficiency of the heat exchanger generated by circulating water through these interconnected fractures.

45851 (EUR—8853-EN, pp 775-784) **Hot dry rock exploration techniques in the British Caledonides.** Lee, M.K.; Brown, G.C.; Wheildon, J.; Webb, P.C.; Rollin, K.E. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Previously, heat flow measurements over large crystalline intrusive bodies in the UK have been confined to south-west England and the north Pennine region. These and other heat flow studies in the UK and elsewhere suggest that two of the most important criteria for high heat flow over crystalline intrusions are (1) high radiogenic heat production, which tends to occur in the most evolved granites, and (2) large intrusive volume indicated by a strong negative Bouguer gravity anomaly which suggests that the granitic layer extends to a depth of many kilometres. In northern Britain a large number of Caledonian-age intrusions were studied. Drillings have been carried out on the Shap and Skiddaw granites in the Lake District and the Cairngorm, Mount Battock, Bennachic and Ballater granites in the Eastern Highlands.

45852 (EUR—8853-EN, pp 241-261) **Community demonstration programme in the field of geothermal energy.** 1984. (In French.). Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The goals of the EC demonstration project are outlined, and the grounds for the decision concerning financial aid are presented along with a brief status report. The projects receiving financial aid in the various EC countries are described and classified according to high-enthalpy and low-enthalpy geothermal energy. The participating countries are: Belgium, The Netherlands, Denmark, The Federal Republic of Germany, Great Britain and Northern Ireland, Italy, and France.

45853 (EUR—8853-EN, pp 381-384) **Geochemistry of geothermal water.** Michard, G.; Roekens, E.; Grimaud, D.; Denis, J. 1984. (In French.). Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The chemical composition of thermal and geothermal water was analyzed under the following aspects: 1. The relative influence of temperature and mineral associations on the chemical composition of hydrothermal systems. 2. The influence of pressure. 3. The role of mobile ions. 4. The behaviour of trace elements. 5. The development of the thermal solution between reservoir and discharge.

45854 (EUR—8853-EN, pp 385-389) **Thermal and mineral water of the French Alps.** Michard, G.; Grimaud, D. 1984. (In French.). Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The geothermal potential of the French Alps was investigated by means of a systematic analysis of all springs listed in the "Annales des Mines", September 1975. Several types of water could be distinguished by the chemical analyses. The geochemistry and genesis of the water samples are described. Remarks are made on the use of chemical geothermometers.

45855 (EUR—8853-EN, pp 492-494) **Findings of the geothermal exploratory well at Bagatelle, Montpellier (Herault/France).** 1984. (In French.). Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The Bagatelle region has two aquifers for geothermal exploration: Limestones of the middle Jurassic close to the surface and dolomites of the Hettangian (basal stage of Lias) in a depth of 2000 m. The characteristics and potential of the subsurface Jurassic reservoir are described.

45856 (EUR—8853-EN, pp 627-644) **Magneto-telluric study in Travale Area.** 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The differences between the new and the classic magnetotelluric method are described. The new M.T. method (M.T. -5-E.X.) was used in 1981 for studies in the Travale region. Two laboratories were used. The methodology is described, and some difficulties are reported. The measured data and the findings derived are discussed.

45857 (EUR—8853-EN, pp 654-667) **Test of EM methods (TRANSIEL-M.T.) in the Travale area (Italy).** 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The Transiel method of the Compagnie Generale de Geophysicque was used for the first time in the Travale region. Polarisation anomalies are measured which may be caused by pyritisation processes. The theoretical and experimental aspects of the method

are dealt with as well as the possible interpretations. The measurements, the methodology, and the findings obtained in the Travale region are discussed. Further studies were carried out by a conventional M.T. method, and the data obtained were compared with a view to their accuracy.

45858 **(LA-UR—84-2564) Deep drilling technology for hot crystalline rock.** Rowley, J.C. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 70p. (CONF-840572—4). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84016475.

From International symposium on observation of the continental crust through drilling; Tarrytown, NY, USA (20 May 1984).

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The development of Hot Dry Rock (HDR) geothermal systems at the Fenton Hill, New Mexico site has required the drilling of four deep boreholes into hot, Precambrian granitic and metamorphic rocks. Thermal gradient holes, four observation wells 200 m (600 ft) deep, and an exploration core hole 800 m (2400 ft) deep guided the siting of the four deep boreholes. Results derived from the exploration core hole, GT-1 (Granite Test No. 1), were especially important in providing core from the granitic rock, and establishing the conductive thermal gradient and heat flow for the granitic basement rocks. Essential stratigraphic data and lost drilling-fluid zones were identified for the volcanic and sedimentary rocks above the contact with the crystalline basement. Using this information drilling strategies and well designs were then devised for the planning of the deeper wells. The four deep wells were drilled in pairs, the shallowest were planned and drilled to depths of 3 km in 1975 at a bottom-hole temperature of nearly 200°C. These boreholes were followed by a pair of wells, completed in 1981, the deepest of which penetrated the Precambrian basement to a vertical depth of 4.39 km at a temperature of 320°C.

45859 **(NMERDI—2-67-2135) Evaluation of the geothermal resource in the area of Albuquerque, New Mexico.** Jiracek, G.R.; Swanberg, C.A.; Morgan, P.; Parker, M.D. (New Mexico Univ., Albuquerque (USA). Dept. of Geology). Jul 1983. 181p. NTIS, PC A09/MF A01 - NMERDI-Univ. of New Mexico, 117 Richmond Dr., Albuquerque, NM 87106. File Number DE84901855.

Factors indicating a potential geothermal resource near Albuquerque are: (1) nearby volcanoes active as recently as 120,000 years ago, (2) gravity interpretation indicating a potential reservoir averaging 1.5 km thickness, (3) high heat flow near the city, (4) warm waters (>30°C) in municipal wells, (5) recent seismicity indicating active faulting, thereby, allowing the possibility of deep hydrothermal circulation, (6) high shallow (<30 m) temperature gradients (>100°C/km) discovered in our drillholes, (7) deeper (<500 m) gradients from water wells exceeding 80°C/km, and (8) chemical analyses of 88 groundwater samples yielding estimated base reservoir temperatures as high as 190°C. An area of elevated shallow temperature gradients (≦ 140°C/km) was discovered a few kilometers west of Albuquerque by our 69 hole drilling program. Resistivity, magnetic, and gravity measurements combined with computer modeling suggest that heated ground water is forced closer to the surface here by flow over a buried ridge. A well drilled nearby yielded the highest recorded temperature in the Albuquerque area at its maximum depth (32.8°C at 364 m). The deep gradient is 35°C/km. An oil test well closeby reported large volumes of water at 1 km; therefore, the possibility of a low temperature (>50°C) geothermal resource exists west of Albuquerque at less than 1 km depth.

45860 **(NMERDI—2-69-2202) Geothermal low-temperature reservoir assessment in Dona Ana County, New Mexico. Final report.** Icerman, L.; Lohse, R.L. (New Mexico State Univ., Las Cruces (USA). New Mexico Energy Inst.). Apr 1983. 198p. NTIS, PC A09/MF A01 - NMERDI-Univ. of New Mexico, 117 Richmond Dr., Albuquerque, NM 87106. File Number DE84901823.

Sixty-four shallow temperature gradient holes were drilled on the Mesilla Valley East Mesa (east of Interstate Highways 10 and 25), stretching from US Highway 70 north of Las Cruces to NM Highway 404 adjacent to Anthony, New Mexico. Using these data as part of the site selection process, Chaffee Geothermal, Ltd. of Denver, Colorado, drilled two low-temperature geothermal production wells to the immediate north and south of Tortugas Mountain and encountered a significant low-temperature reservoir, with a temperature of about 150°F and flow rates of 750 to 1500 gallons per minute at depths from 650 to 1250 feet. These joint exploration activities resulted in the discovery and confirmation of a 30-square-mile low-temperature geothermal anomaly just a few miles to the east of Las Cruces that has been newly named as the Las Cruces east Mesa Geothermal Field. Elevated temperature and heat flow data suggest that the thermal anomaly is fault controlled and extends southward to the Texas border covering a 100-square-mile area. With the exception of some localized perturbations, the anomaly appears to decrease in temperature from the north to the south. Deeper drilling is required in the southern part of the anomaly to confirm the existence of commercially-exploitable geothermal waters.

45861 (NP—4770405, pp 51-60) **Examination of mineral and thermal springs in the Eifel mountains for geothermal indications.** Langguth, H.R.; Plum, H.; Kimmelmann, A.; Schulz, R. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

In the regions of the Eifel and Ardennes mountains, 147 mineral and thermal spring were re-sampled and analyzed for dissolved ingredients, composition of spring gases and selected isotope ratios. Analysis results were evaluated for geothermal indications and were interpreted.

45862 (NP—4770405, pp 81-92) **Pilot project for utilizing low-enthalpy geothermal deposits in the Upper Rhine Graben of the Federal Republic of Germany.** Schaumberg, G. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

Description of the preparatory studies for the pilot project concerning utilization of hot waters circulating naturally in the subsoil for residential heating. Along with the drilling record, there is a description of swabbing tests implemented and of the results of the total project.

45863 (NP—4770405, pp 93-98) **Exploration and utilization of geothermal energy for base-load supply of existing heating systems.** Czink, F.; Koepper, J. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

Geologic conditions, drilling results and the technology employed are described for the drilling project of Bremgarten 1 which is to develop low-temperature geothermal energy for heating an existing system. The article contains a profititability study carried out, too.

45864 (NP—4770405, pp 99-112) **Saulgau geothermal demonstration project.** Bertleff, B.; Cammerer, F.; Fritz, J.; Haenel, R.; Michel, W.; Werner, J. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

The report comprises the description of the Saulgau project and descriptions of the TB1 thermal water drilling and the GB3 geothermal drilling with the latter in a detailed way giving a geologic profile, a list of water-entry areas and statements on technical productivity. Temperature measurements, thermal conductivity determinations and regional studies in the malmstone karst of the molasse basin are contained in the article as are model calculations for examining flow phenomena within the malm aquifer. As a conclusion, there is an overview on the remaining activities programme.

45865 (NP—4770405, pp 113-128) **Experiments performed on a man-made crack in the flat low-permeability basement as a basis for large-scale technical extraction of terrestrial heat.** Kappelmeyer, O.; Jung, R.; Rummel, F. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

Research work is performed on an in-situ experimental field in the crystalline subsoil near Falkenberg in East Bavaria which are to help develop new technologies for exploiting geothermal energy. The aim is to make terrestrial heat available for technical utilization even with a relatively normal geologic structure of the subsoil - i.e. far away from volcanos and outside of layers carrying water or steam. To achieve this objective, artificial heat exchange systems were produced by hydraulic fracturing of crystalline rocks at a depth of 250 m. Geometric positions of these cracks were located by means of seismic and geo-electric methods. Seismic observations allowed deriving a crack model which helped with penetrating the man-made crack by sectional drilling. The circulation system consisting in production drill-hole, crack system and sectional drill-hole was studied for hydraulic parameter (e.g. flow resistance) and thermal efficiency at various pressure levels in the crack. Crack width was measured at different pressure stages for the first time. Thermal model calculations allow transferral of the results gained from the flat relatively cool basement to basement areas of an elevated temperature. A number of rock parameters which are relevant for an assessment whether or not the subsoil is suitable for creating artificial heat exchange systems, were examined on-site and bench-scale.

45866 (NP—4770405, pp 129-142) **Frac studies on the extended research borehole of Urach.** Dietrich, H.G. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

A summary of the results obtained with frac and circulation tests in the Urach research bore hole, sofar, is followed by a report on supplementary results, like flow rate and water losses, with the circulation tests performed with all statements corroborated by diagrams.

45867 (NP—4770405, pp 143-168) **Geophysical exploration of geothermal deposits.** Wohlenberg, J. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

Description of individual deposit types and basic geophysical exploration methods. As special exploration methods for geothermal deposits, the author discusses geothermal measurements, seismologic methods, electric and electromagnetic methods as well as measurement of gravity and of the terrestrial magnetic field with the author discriminating between active and passive exploration methods.

45868 (NP—4770405, pp 169-182) **Exploration of the temperature field near Urach and testing of geophysical and geochemical methods.** Haenel, R. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

In the years 1977 to 1981, the geothermal anomaly of Urach (Stuttgart) was studied by means of several geoscientific methods. This included not only an examination of the geophysical methods for their statements on the temperature field but also an attempt to present a crust model based on the results obtained from the various methods. An increased heat transport by water and/or gas from a great depth is presumed as the cause of the elevated temperatures found near the surface. The heat source is assumed to be located in the upper mantle. The Urach research project stimulated a number of South German communities to examine and realize the potentiality and exploitation of thermal water.

45869 (NP—4770405, pp 183-200) **Seismic reflection examinations of structural and lithologic parameters in a geothermally anomalous area exemplified by Urach.** Meissner, R.; Trappe, H.; Flueh, E. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

Whereas the seismic data evaluated till now concerning the thermal anomaly of Urach have focussed on the refraction near the surface and espec. on steep-angle reflexion, the present article shows the results of broad-angle reflexions. These were obtained by additional refraction stations along the steep-angle profiles and up to 85 km beyond, and show a number of clear-cut on-sets. The results not only supply new information far beyond the profile ends but also supplement the results of the steep-angle data: a somewhat deeper-lying upper ceiling was found for the calculated spatial area under Urach where lower seismic velocities were measured. The position of the area was fully confirmed by the broad angle measurements. Slight modifications of the velocity structure and depth of several interfaces are compatible and show that optimum interpretation can be obtained by a close symbiosis of both measuring methods only.

45870 (NP—4770405, pp 201-222) **Seismic and geo-electric frac-detection from the earth's surface.** Wierczeyko, E. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

Exemplified by the test field of Frankenberg/Oberpfalz, the article describes geo-electric methods for determining the main propagation orientation of a hydraulic fracture and the application of seismic methods and their results.

45871 (NP—4770405, pp 237-258) **Electric conductivity measurements of rocks, depending on pressure, temperature and rock state.** Nover, G.; Hinze, E.; Will, G. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

The electric conductivities of drill core samples from the crystalline of the FB Urach 3 and Falkenberg HB 4 were determined as functions of the parameters of porosity, pore filling, electrolyte, pressure and temperature. Rock permeabilities derived from the rock porosities and guide values measured. The data were correlated with the existing drill-hole log: rock resistances, oscillations of seismic wave velocities and change of rock resistance with frac could be interpreted as functions of porosity, degree of filling, electrolyte pressure, lithostatic stress field and permeability.

45872 (NP—4770405, pp 259-270) **Application of active audiomagnetotellurics for exploiting geothermal deposits.** Musmann, G.; Otten, J. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

Currents of up to +- 20 Asub(ss) are fed to the soil via an electric dipole of 300-600 m length in the frequency range of .01 Hz to 10 kHz. In the receiving station c. 10 km away, the three magnetic field components and two E-field components are recorded, with the transmitter and the receiver being connected via a PCM telemetry section for synchronization (correlation), language communication and transmission of zero phase information. At the receiver station, the components measured in the field are correlated with the transmitted function fed in to improve the signal-to-noise ratio. As a result, the apparently specific resistances and phases in the field are indicated depending on the frequency. Recording the conductivity distribution of the upper c. 10 km at a data point takes about 1 day. First test measurements show smooth graphs and reproduceable measuring results.

45873 **Development of a high temperature pH electrode for geothermal fluids.** Niedrach, L.W.; Stoddard, W.H. (General Electric Company, Corporate Research and Development Center, Schenectady, New York). *Journal of the Electrochemical Society;* **131**: No. 5, 1017-1026(May 1984).

This work demonstrates the applicability of a stabilized zirconia pH sensor to high temperature measurements on brines containing as much as 20 weight percent NaCl and 100 ppm hydrogen sulfide. Throughout the program, stable operation was achieved, and measured pH values from 3 to 9 were in good agreement with calculated values. Differences were generally less than 0.5 pH unit at 285°C, and it is not yet certain whether the discrepancies are associated with the measured or calculated values of the pH. Two sensors were operated at 285°C for periods of 11 days, and one was employed in successive tests for a total of 37 days. At the end of this period, the sensor was still satisfactory, and it was forwarded to the sponsoring laboratory, PNL, for further tests. Although most of the work was performed at 285°C, a limited amount of testing was done at lower temperatures: 95°, 150°, and 225°C. Sensors prepared from in-house tubes and from tubes obtained from an outside supplier performed well at 95°C for extended periods, in spite of earlier difficulties with the standard ceramic at this temperature. There is still, however, some uncertainty concerning the adequacy of our seals, particularly in cycling between 285°C and lower temperatures. In a brief experiment, one sensor was operated satisfactorily at 285°C and 5000 psi pressure. (Normal operation was at 1200 psi.)

45874 **Geothermal gradients in Mississippi embayment.** Staub, W.P.; Treat, N.L. (Oak Ridge National Lab., TN). *American Association of Petroleum Geologists, Bulletin;* **67**: No. 9, 1460(Sep 1983). (CONF-8310301—).

From American Association of Petroleum Geologists eastern section meeting; Carbondale, IL, USA (3 Oct 1983).

A statistical analysis of bottom-hole temperatures from oil and gas wells in the northern Mississippi embayment suggests that the geothermal gradient below a depth of 1 km is low (22.2°C/km) and for the New Madrid seismic zone, it is even lower (15.7°C/km). These data support the tentative conclusion of Swanberg et al that ground-water convection is the source of near-surface heat in shallow water wells of the region. Research by Mitchell et al had suggested a high geothermal gradient in the crust and upper mantel beneath the New Madrid seismic zone as a plausible explanation for the lower than average compressional wave velocities observed there. Warmer than normal wells in the northern Mississippi embayment are scattered at random and may be attributed to random error in the data. Deep wells in the southern Mississippi embayment are substantially hotter than wells at a comparable depth farther north. The regional geothermal gradient below a depth of 1 km from northern Louisiana to central Mississippi is 26.9°C/km. From central Mississippi to central Alabama, the geothermal gradient (23.1°C/km) is comparable to that of the northern Mississippi embayment.

1505 Economic And Financial Aspects

REFER ALSO TO CITATION(S) 15050045781, 45786, 45863

45875 (EUR—8853-EN, pp 201-209) **U.K. drilling cost estimation.** Harrison, R.; Mortimer, N.D. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

A drilling cost estimation procedure has been developed in which physical parameters of drilling time, casing quantity, etc., are estimated and combined with unit costs of rig hire, casing etc., to determine overall well costs. An important sub-model is the estimation of drilling time; this sub-procedure uses instantaneous rates of penetration at different depths and also bit life estimates as input data. With generalized data on instantaneous rates of penetration and bit life this sub-model yields estimates of drilling time which are consistent with experience for the Wessex and Aquitaine basins. From a study of U.K. and U.S. well costs and rig rates it is concluded that official exchange rates are misleading when comparing well costs. Also there may be no significant differences in rig rates in the two countries.

45876 (NP—4770389) **Geothermal energy in Switzerland.** Datwyler, J.J. (Eidgenoessiche Fachkommission fuer die Nutzung Geothermischer Energie und die Unterirdische Waermespeicherung, Bern (Switzerland)). Oct 1982. 30p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84770389.

Three reports on low-temperature geothermal heat in Switzerland have been compiled on behalf of the KGS: "Swiss geothermal data synthesis", "Technical and economic study on geothermal energy utilisation in Switzerland", and "Study on the potential market for geothermal energy in Switzerland". The reports are summarized.

45877 **Simplified method for calculating recoverable energy content from geopressured geothermal brines.** Goldsberry, F.L. (Dept. of Energy, Washington, DC). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **17**: vp(1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Paper 829181.

The geopressured energy index (GEI) serves as a simple method for calculating the recoverable energy content of geopressured-geothermal brines for purposes of economically evaluating production prospects. The concept reduces each component - methane, heat, and hydraulic power - to a reasonable attainable energy equivalent per barrel of brine. Electric power generation was selected as the common denominator. When combined with the well-production projection from a specified reservoir, the GEI can describe the economic potential of a prospect.

1506 Environmental Aspects And Waste Disposal

REFER ALSO TO CITATION(S) 15060046572

45878 **(DOE/EV/04255—3) Evaluation of H_2S control technology for geothermal energy sources. Monthly report.** (Midwest Research Inst., Kansas City, MO (USA)). 1 Nov 1977. Contract AC02-77EV04255. 20p. (COO—4255-3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017629.

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The initial task involved an extensive review of the literature to identify ongoing and planned geothermal developments and potentially applicable H_2S control technology. Contacts were also made with individuals and agencies involved with the development of H_2S control technology for geothermal applications. Task 2 efforts involve review of available experimental and operating data for H_2S control systems which have been applied to geothermal sources and preparation of a state-of-the-art report on H_2S removal systems. In this task, data are also being acquired on ongoing H_2S control development programs. Task 3 efforts involve the evaluation and development of a listing of candidate clean-up systems which could be used for future geothermal energy development projects. Projects being considered include electric power generation as well as selected nonelectric applications. Source characterization involves identification of process (source) parameters as well as ranges of key emission variables.

45879 **(DOE/NV/10174—T1) Results from geopressured-geothermal subsidence studies.** Trahan, D.B. (Louisiana Geological Survey, Baton Rouge (USA)). 1984. Contract AC08-81NV10174. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016279.

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Benchmark networks have been installed around each of the US Department of Energy geopressured-geothermal test sites in southwestern Louisiana. These networks are periodically surveyed to detect subsidence which may be attributable to depressurization of the geopressured-geothermal reservoirs. The acquired leveling data have been adjusted to account for regional base-line movement determined in another study. The effects of geopressured-geother-

mal development can only be assessed after carefully examining other potential causes of subsidence. The histories of oil and gas production and ground-water withdrawal around the geopressured-geothermal test site at Parcperdue indicate that oil, gas, and ground-water production may contribute much more to anomalous subsidence than recent geopressured-geothermal brine production. A trend-surface analysis of leveling data for the Parcperdue test site allowed for the separation of a regional component of movement attributable to uplift in the Iberian structural axis to the east and subsidence above a Pleistocene depocenter to the west of the test site. Residual deviations from the regional trend may be associated with the temporary loading and compaction of surface soils caused by the weight of drilling equipment and with ground-water withdrawal.

45880 **(NMERDI—2-69-2209) Monitoring environmental and related performance parameters for a Rankine-cycle turbine electric generator utilizing geothermal energy at the Gila Hot Springs, New Mexico. Final technical report.** Starkey, A.H.; Icerman, L. (New Mexico State Univ., Las Cruces (USA). New Mexico Energy Inst.). Aug 1984. 23p. NTIS, PC A02/MF A01 - NMERDI-Univ. of New Mexico, Suite M, 457 Washington SE, Albuquerque, NM 87108. File Number DE84901772.

This project was undertaken to provide data to state and federal regulatory groups on the environmental effects, if any, associated with the operation of a privately-owned Rankine-cycle turbine-generator unit using low-temperature geothermal resources in the form of free-flowing hot springs to produce electricity in a remote, rural area. Because the turbine-generator system to be monitored was never on-line for a substantial period during the project, no environmental conclusions can be drawn. The following conclusions pertain to the operation of the turbine-generator system: (1) the heat exchanger could not provide sufficient freon vapor at the required pressures to provide adequate thermal input to the turbine; (2) conversion or redesign of the condenser and return pump to function adequately represents a problem of unknown difficulty; (3) all pressure and heat transfer tests indicated that a custom-designed heat exchanger built on-site would provide adequate vapor at pressures high enough to power a 10-kW/sub e/ or perhaps larger generator; and (4) automated control systems are needed for the hot and cold water supplies and the freon return pump.

45881 **(PB—84-190586) Field studies of geomembrane installation techniques. Technical paper.** Shultz, D.W. (Southwest Research Inst., San Antonio, TX (USA)). May 1984. 16p. NTIS, PC A02/MF A01.

Fourteen construction sites where geomembranes were being installed were visited to observe subgrade preparation and liner installation techniques. These sites were visited during a study conducted for the U.S. EPA, Solid and Hazardous Waste Research Division. The sites included mine tailing disposal impoundments, landfills, potable water reservoirs, geothermal brine impoundments, evaporation impoundments, and industrial wastewater treatment impoundments. Six generic types of geomembrane materials were included in this study. They were (1) polyvinyl chloride (PVC); high density polyethylene (HDPE); (3) chlorosulfonated polyethylene (CSPE); (4) chlorinated polyethylene (CPE); (5) Neoprene; and (6) ethylene propylene diene monomer (EPDM). Observed subgrade preparation procedures and geomembrane installation techniques are described in this paper.

1508 Geothermal Power Plants

REFER ALSO TO CITATION(S) 15080045781, 45852, 45880

45882 **(DOE/ID/12478—T4) Binary generating units at Kelly Hot Springs, California.** Karlsson, T. (Oregon Inst. of Tech., Klamath Falls (USA). Geo-Heat Center). Aug 1984. Contract FG07-83ID12478. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017363.

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Temperature measurements in the wells drilled in the area around Kelly Hot Spring in northeastern California indicate the presence of an extensive aquifer covering several square miles at 1600 to 3300 feet in depth. The water temperature in the aquifer is in the range of 212° to 239°F. No flow tests of wells in the area have been carried out. A proposal from Ormat Turbines, Ltd. for a binary power plant generating 1500 kW has been submitted to the owners of the area around Kelly Hot Spring. The proposal calls for a total of 1800 gpm of geothermal fluid at 220°F and 7500 gpm of cooling water at 55°F. Assuming that the required geothermal fluid can be produced from three production wells, each drilled to a depth of 3000 feet, an economic analysis of this project has been carried out. The results indicate that at 6.6% annual rate of interest, the project will return the initial capital investment of $5,400,000 in twenty years. This assumes full 25% investment tax credit (10% business, 15% energy) for capital investment costs other than drilling costs.

45883 **(EGG-M—09884) Heat Cycle Research Program.** Demuth, O.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 6p. (CONF-840809—20). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017015.

From Geothermal Resources Council annual meeting; Reno, NV, USA (27 Aug 1984).

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The overall objective of the Heat Cycle Research Program, which is being conducted for the Department of Energy, is to develop technology for effecting improved utilization of moderate temperature geothermal resources. Major thrusts of the effort are directed toward: (1) advances in binary cycle technology, (2) development of direct-contact heat exchanger technology for use in applications with resources having high corrosion or scaling potential, and (3) special studies including value analyses for estimating economic advantages of plant improvement concepts and studies of other energy conversion cycles. Some background information relative to the program is presented; the progress and program results to date are summarized; the current effort is discussed briefly; and finally some plans for future tasks are outlined.

45884 **(EGG-M—10184) Initial results for supercritical cycle experiments using pure and mixed-hydrocarbon working fluids.** Bliem, C.J.; Mines, G.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 6p. (CONF-840809—18). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017008.

From Geothermal Resources Council annual meeting; Reno, NV, USA (27 Aug 1984).

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The Heat Cycle Research Program, which is being conducted for the Department of Energy, has as its objective the development of the technology for effecting improved utilization of moderate temperature geothermal resources. Testing at the Heat Cycle Research Facility (HCRF) located at the DOE Geothermal Test Facility (GTF), East Mesa, California, is presently being conducted to meet this objective. Current testing involves a supercritical vaporization and countercurrent in-tube condensing system. The paper presents a brief description of the test facility and a discussion of the test program. Preliminary results on the performance of the supercritical heaters, countercurrent in-tube condenser, and turbine are given for both pure and mixed-hydrocarbon working fluids.

45885 (EUR—8853-EN, pp 210-213) **Design and experimentation of a low temperature motor driven fan convector prototype.** Soupault, O. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

As a result of a previous research, a convector, named Evovecteur, which uses a free convection principle, has been designed. In the Ecovecteur, a natural draught effect is achieved by means of a chimney, two meters high, which clearly has some geometric implications to fit in existing dwellings. Therefore, in order to overcome this geometric constraint, the present research aimed at substituting for free convection a forced convection principle using a fan convector, the motor being either hydraulic or electric.

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 15090045781, 45799, 45808, 45830, 45836, 45837, 45849, 45850, 45858, 45865, 45866, 45870, 45896

45886 **(DOE/SF/12197—1) Similarity considerations in one-component two-phase flow.** Maeder, P.F.; DiPippo, R.; Dickinson, D.A.; Nikitopoulos, D.E. (Brown Univ., Providence, RI (USA). Div. of Engineering). Jul 1984. Contract AC03-84SF12197. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84016370.

The simplified model fluid presented here for two-phase flow can serve as a basis for the similarity analysis of a variety of substance flows. For the special case of water and R114, it is seen that exact similarity does not exist in the range of interest for geothermal applications, but that conditions can be found for reasonable similarity which permit one to replace water with R114 in laboratory-size apparatus. Thus experimental data and results obtained using R114 in a properly scaled laboratory setup can be converted with reasonable accuracy to those for water.

45887 (EUR—8853-EN, pp 477-481) **Geothermal well light-weight cementing compositions.** Martin, M. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Cementing material compositions with a density less than 1 500 kg/m^3 are studied for application to high-enthalpy geothermal wells. The first selection is based on the behavior of material specimens after curing in simulated bottom-hole conditions, at high temperature (until 350°C) and under high pressure (until 50 MPa). In the present step of the study, the mainly involved characteristic is the compressive strength Rsub(c).

45888 (EUR—8853-EN, pp 482-491) **Development of a new high reliability downhole pumping system and its application to water lift for geothermal energy recovery.** Grant, A.A. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Artificial lift pumping systems, are characterised by the requirement for high horsepower installed downhole in a high temperature environment. For these, and similar applications, experience has shown that the technical difficulties encountered in the extrapolation of existing submersible electric motor technology are severe resulting in poor service reliability and high maintainance cost. The author describes the concepts incorporated, to overcome these difficulties, in an entirely new patented hydraulically powered downhole pumpset which has been developed with support from two large oil companies and the U.K. Department of Energy. Laboratory test and field operating experience is discussed in relation to reliability objectives, and the main performance features which have particular relevance to geothermal energy recovery applications are reviewed.

45889 (EUR—8853-EN, pp 495-500) **Preliminary evaluation testing of well performance, surface scaling and reinjection processes in the Mofete water-dominated field.** Guglielminetti, M.; Tore, G. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Testing of water dominated geothermal fields has long been, and is still often limited to Russell-James method; Agip checked the test methodology which can be described as a large scale PVT facility. It basically consists of a steam separator, surface gauging and sampling facilities on both steam and brine line and down hole P, T instrumentation. A pit-test unit was designed and constructed by AGIP and was used for testing of the Mofete 1 and Mofete 2 geothermal wells. Down hole measurements conducted during the two pit tests showed that there is not only one but at least two, perhaps even more than two reservoirs on top of each other within this geothermal area.

45890 (EUR—8853-EN, pp 501-513) **Assessment of the role of numerical simulation in modelling Travale geothermal field.** Carradori, G.; Peano, A.; Ceron, P.; Neri, G. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

A general-purpose numerical computer code is applied to model Travale geothermal field. Different reservoir engineering data, such as draw-down, interference, build-up tests obtained during a production period of about ten years are examinated and satisfactorily interpreted, giving for the first time a coherent explanation of reservoir characteristics. This case history points out the role of numerical simulation in crosschecking the consistency of various hypotheses on the structure of a geothermal reservoir, as induced from geological, geophysical and reservoir performance data. In particular the paper portrays the evolution from simpler to more complex numerical models, as required to take into account more detailed aspects of the measured well data.

45891 (EUR—8853-EN, pp 514-524) **Mofete field, Italy: A numerical model study.** Chierici, G.L.; Giannone, G.; Sclocchi, G. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The capability of a specific numerical reservoir simulator to match and forecast geothermal well and field behaviour was tested on the Mofete field, Italy. The selected numerical model, CHARGR, was first validated on six test cases proposed by DOE. Results of well tests carried out at Mofete well No. 2 were matched by using a 2D axisymmetric version of the model. Matching temperature build up along the well after a cold water injection test allowed to evaluate kh distribution along the producing formation; the total kh value was evaluated by matching the results of a subsequent pit test. Reservoir response to various production schedules was evaluated by means of a 2,500 cells, 3D version of the model. Cases with different number of wells and production/ reinjection rates were simulated.

45892 (EUR—8853-EN, pp 564-565) **Reinjection of oilfield brines into clastic reservoirs and its bearing on the reinjection of low enthalpy geothermal brines.** Ten Dam, A.; Vetter, O.J. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The objectives of this paper are (a) to summarize the history and technology of the reinjection of oilfield brines into depleted sandstone reservoirs of the Los Angeles basin in California (U.S.A.), (b) to identify the similarities and differences between oilfield and low enthalpy geothermal brine reinjection schemes, (c) to list the potential reinjection problems and (d) in the light of the previous oilfield and low enthalpy geothermal brine injection experience, suggest solutions to most of the problems encountered in drilling and operating these injection wells.

45893 (EUR—8853-EN, pp 693-750) **Hot dry rock reservoir stimulation in the UK.** Batchelor, A.S. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

This work has been carried out by a research team from the Camborne School of Mines and has been located in Cornwall. The area has been shown to have a high natural heat flow associated with an underlying granite batholith. The granite is pervasively jointed in two dominant directions. The concept of energy extraction is that the natural jointing can be hydraulically stimulated to form interlinking paths between multiples of pairs of wells. During the drilling, stress measurements were made by hydraulic fracturing and subsequently confirmed by an overcoring programme in a local mine. Equilibrium temperature measurements have been made and the thermal regime of the area has been confirmed. Geophysical logging coupled with low flow injection tests were used to identify joints accepting or producing fluid in the wells prior to stimulation.

When these tests were complete a specially built explosive charge was used to pre-treat the injection well prior to massive hydraulic stimulation into the joints.

45894 (NP—4770405, pp 223-236) **Permeability measurements and frac experiments in the IRDP borehole of Eastern Iceland.** Rummel, F.; Haimson, B.C. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

In 1978 an C. 2000 m deep research bore-hole was established in the basalt crust of Eastern Iceland under the participation of geoscientists from Iceland, the USA, Canada, Denmark and the FRG. Along with numerous geochemical, mineralogical and geophysical examinations, permeability measurement and hydraulic-fracturing stress measurements were performed in the borehole in summer 1979. The latter were carried out in cooperation between the Ruhr-Universitaet Bochum and the University of Wisconsin, Madison, USA. The tests aimed at gaining experience with frac activities in a basalt crust with a view to utilizing geothermal energy and at comparing the results of frac tests obtained with two different measuring equipments. Measurements were performed in the upper non-cased part of the bore-hole by means of a double packer equipment which allows both pressure shock tests for measuring rock permeability and frac tests.

45895 (SAND—84-7101) **Geological formation - drill string dynamic interaction finite-element program (GEODYN). Phase 1. Theoretical description.** Baird, J.A.; Apostal, M.C.; Rotelli, R.L. Jr.; Tinianow, M.A.; Wormley, D.N. (Jordan, Apostal, Ritter Associates, Inc., Davisville, RI (USA)). Jun 1984. Contract AC04-76DP00789. 193p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE84017021.

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The Theoretical Description for the GEODYN interactive finite-element computer program is presented. The program is capable of performing the analysis of the three-dimensional transient dynamic response of a Polycrystalline Diamond Compact Bit-Bit Sub arising from the intermittent contact of the bit with the downhole rock formations. The program accommodates nonlinear, time-dependent, loading and boundary conditions.

1510 Direct Energy Utilization

REFER ALSO TO CITATION(S) 15100045825, 45836, 45852, 45876

45896 (DOE/ID/12478—T3) **Downhole heat exchanger system for Sharpstein Museum, Brannon Cottage, and the Community Center, Calistoga, CA. Feasibility study.** Culver, G. (Oregon Inst. of Tech., Klamath Falls (USA)). Aug 1984. Contract FG07-83ID12478. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016295.

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Based on the results of the test drilling at the Sharpstien Museum and Community Center, a well at the site should provide space heating for the Museum and Community Center, and domestic hot water for the Community Center utilizing a downhole heat exchanger (DHE). Although the temperatures observed in the well are very low, a suitable system can be designed and installed. Not including the cost of the well and testing, which is assumed to be borne by the California Energy Commission for demonstration and scientific research purposes, the simple payback is between 4.6 and 7.5 years depending on the cost of the experimental convection promotor.

45897 (EGG-M—10284) **Results of thirteen direct heat applications projects.** Childs, F.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 6p. (CONF-840809—19). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017009.

From Geothermal Resources Council annual meeting; Reno, NV, USA (27 Aug 1984).

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The application of geothermal applications is being aided by twenty-three field-experiment projects. The projects provide a current experience base against which the private and municipal sectors can evaluate potential projects and on which they can base their project plans. The results of thirteen of these projects are presented with emphasis on: energy replaced, economic payback, system designs, and resource assessment and development. The thirteen projects currently replace about 58,000 barrels of oil per year and avoid an imported oil cost of $1.7 million/year. They have a future potential of 84,000 barrels/year and $2.5 million/year.

45898 (EUR—8853-EN, pp 214-217) **Feasibility of electricity generation from medium enthalpy (100-200°C) geothermal sources.** Pempie, P.; Potiron, A.; Mauconduit, M.; Grossin, R. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

This report addresses the technical and economical feasibility of electric power generation from medium to high enthalpy geothermal sources which represent a wide range of resources, many of them unexploited to date. The report reviews existing and non conventional conversion cycles, processes and engines. Emphasisis placed on calculation of cycle, system and economic efficiencies of the candidate cycles for extracting energy from medium enthalpy geothermal brines.

45899 (EUR—8853-EN, pp 221-228) **Testing of a R114 - brines direct contact heat exchanger.** Anguillesi, G.; Nardini, G.; Cabella, A. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

A preliminary study of feasibility of a direct contact cycle using R114 has been carried out in order to evaluate fluid losses. For the simulation of behaviors of organic fluid and brines as from variation of density with temperature experimental runs have been carried out using a water and sodium chloride solution and carbon tetrachloride and its solutions with petrolatum as organic phase. A laboratory pilot plant with direct contact heat exchanger has been designed and installed. Information obtained by this pilot plant will be used for possible design of a full scale plant operating with a direct contact heat exchanger.

45900 (EUR—8853-EN, pp 229-231) **Techno-economic study of energy conversion from geothermal brines using two phase thermodynamic cycle.** Grossin, R.; Sagnes, P.; Bussac, F. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Currently, two processes for electricity production can be used: the flash process and organic Rankine cycles. The ongoing research program presented here concerns a third process, using a two phase turbine expanding directly geothermal brines, which would have the following advantages as compared with other conversion systems: - no problems associated with heat exchangers, - conversion of the whole enthalpy containers in the brine, - better compromise between cost and efficiency.

45901 (EUR—8853-EN, pp 275-281) **Metanopoli geothermal project.** Carella, R.; Guglielminetti, M. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The Metanopoli pilot project foresees the geothermal space heating of some dwellings and office buildings in the city of San Donato Milanese. A district heating network fed by conventional thermal plants already exists. Flats are heated through floor slabs. The project has been thought of a pilot plant, first example of production and reinjection in sand/clay formations, part of a central district heating system. It started in summer 1978, based on AGIP geological data relevant to hydrocarbons exploitation in South East of Milan. In particular, a design datum was a production of 100 m^3/

h, at 62°C, upstream the heat exchanger. The reference fuel, as to the economic evaluation of the energy saving, was gasoil.

45902 (EUR—8853-EN, pp 287-294) **Optimum utilisation of geothermal energy in three cascades.** Hanon, M. 1984. (In French.). Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

A municipal district heating system will be installed at Saint-Ghislain on the basis of an existing geothermal well. The low-saline water can be discharged on the surface if the water temperature does not exceed 30°C. The project has been designed in consideration of the heating facilities of the connected buildings, the limited discharge temperature, and the goal of optimum use of the geothermal energy. The residual geothermal energy, with a temperature level of 40°C, will be utilized in two cascades for heating 3000 m^2 of greenhouses and for sewage sludge preheating before methanation in the municipal sewage treatment plant.

45903 (EUR—8853-EN, pp 303-312) **Geothermal hothouses: Horticulture and market gardening at Lamazere (GERS).** Langlet, B.; Goelzer, J. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The horticultural and market gardening district of Lamazere (GERS) is an exemplary demonstration project in the field of geothermal energy. The project has helped to create jobs in the scarcely populated, rural region of Gers and increased the rentability of the market gardening facilities. Producers have thus become more competitive and may be able to revive the slachening national production.

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 15200046791, 46792

45904 (EUR—8853-EN, pp 355-369) **Rock-water interaction in hot dry rock systems.** Althaus, E.; Faller, A.; Herold, G.; Kronimus, B.; Tirtadinata, E.; Toepfer, U. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Fluid-rock interaction experiments in the medium to low temperature range (150° to 350°) show that most rock systems are dominated by feldspar dissolution even if other phases are present in excess. Micas show a dissolution behaviour which makes micaceous rocks very interesting sites for hot dry systems.

45905 (EUR—8853-EN, pp 370-380) **Interaction between rock-forming minerals and fluids under hydrothermal conditions.** Beusen, J.M.; Dack, L. van't; Gijbels, R. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The interaction between rock-forming minerals and aqueous fluids at 200°C may not only result in dissolution of the starting mineral but also lead to the formation of secondary solid phases by precipitation on the surface of the original mineral. The nature and the kinetics of the reactions between selected minerals (augite/aegirine and lepidolite) and aqueous solutions of varying acidity are studied. The contact solutions are analysed by both standard and sensitive multielemental techniques. The surfaces of the altered starting minerals are examined upon their morphology, chemical composition and ion exchange effects by electron microprobe analysis, SIMS depth profiling and/or imaging SIMS and laser microprobe mass analysis. Some hydrothermal experiments are also performed with solutions containing D_2O or $H_2{}^{18}O$ as markers.

45906 (EUR—8853-EN, pp 767-774) **Stability of deep geothermal heat exchange surfaces under thermal load.** Berthomieu, G.; Jouanna, P. 1984. (In French.). Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

The interactions between hot rock (here: granite) and cold water were studied in laboratory experiments. The experimental set-up is described, and the influence of pore pressure on thermomechanical rock fracturing is discussed. The pressure of the pore water must be considered in the calculations. The findings obtained for various temperatures and pressures are discussed.

45907 (EUR—8853-EN, pp 404-405) **Permeability variations of sandstones as a function of temperature and nature and salinity of aqueous percolating solutions.** Baudracco, J.; Dedieu, G.; Tardy, Y. 1984. Commission of the European Communities, Luxembourg. (CONF-8311132—).

From 3. international seminar on the results of EC geothermal research; Munich, F.R. Germany (29 Nov 1983).

Two different samples called Ireland sandstone and Vogesian sandstone were submitted to several percolations by saline aqueous solutions of different concentrations and at different temperatures. The initial pressure was adjusted in a such a way that the initial water flux passing through the samples was for all the same. The differences in pressure and the variations of the water flow have allowed the calculation of the permeability coefficient changes as function of time, temperature, nature of the cation involved and the concentration of the solution. The uncoherent sandstone, was treated as a powder or a sand and the Vogesian sandstone, highly coherent, was treated as a core. The major results obtained are reported below.

45908 (NP—4770405, pp 69-80) **Content of magma and heat in the magma chambers of the Laach Lake and the Rieden Volcano.** Bogaard, P. v.d.; Duda, A.; Schmincke, H.U.; Viereck, L.; Woerner, G. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

A complex eruption activity of the polygenetic Rieden Volcano (8 eruption phases) is deduced from the output of chemically contrasting magmata, indications of long pauses between flows and several caldera collapse phases with formation of a crater lake. Xenolithe compositions point to several intrusion bodies in the volcano's substratum at a low depth. Quantitative examinations of differentiation processes in magmata of the Eastern Eiffel mountains confirm two separate differentiation trends with the crystallization of amphibol constituting a critical parameter.

17 WIND ENERGY

REFER ALSO TO CITATION(S) 17000046103

1704 Economics

45909 (N—84-13670) **MOD-2 wind turbine development.** Gordon, L.H.; Andrews, J.S. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1983. 28p. (NASA-TM—83460; E—1776; CONF-830631—15). NTIS, PC A03/MF A01.

From 6. biennial wind energy conference; Minneapolis, MN, USA (1 Jun 1983).

The development of the Mod-2 turbine, designed to achieve a cost of electricity for the 100th production unit that will be competitive with conventional electric power generation is discussed. The Mod-2 wind turbine system (WTS) background, project flow, and a chronology of events and problem areas leading to Mod-2 acceptance are addressed. The role of the participating utility during site preparation, turbine erection and testing, remote operation, and routine operation and maintenance activity is reviewed. The technical areas discussed pertain to system performance, loads, and con-

trols. Research and technical development of multimegawatt turbines is summarized.

45910 **(SERI/STR—211-2379) Analysis of wind energy systems for selected electric utilities. A final subcontract report.** McCabe, T.F. (JBF Scientific Corp., Wilmington, MA (USA)). Jul 1984. Contract AC02-83CH10093. 332p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE84013025.

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This study assesses the value of Wind Energy Conversion Systems (WECS), the amount a utility could afford to pay for wind machines with no reliability penalties. Nine electric utilities were analyzed, taking into account different wind turbine installation years to determine the effects of changes in generation mix and how capacity displacement would alter fuel savings. The value results are compared on wind resource and WECS performance, current and projected utility characteristics, and utility financial parameters relative to carrying investments in production facilities. Findings include that WECS savings are dependent on generation mix and increase when fuel costs increase, capacity credit ranges considerably and can enhance the value of WECS, and the value of WECS is dependent in a highly complex manner on financial considerations, amount of wind energy available, and per-unit savings.

1706 Wind Energy Engineering

45911 (CONF-8203178—, pp 25-29) **Energy from wind power.** Riegler, G. Jul 1982. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number TI84770366.

From 10. Salzburg economic inquiry; Salzburg, Austria (4 Mar 1982).

Research activities on wind power plants and turbines like tornado turbines in Europe and possible applications in Austria being conditional on wind characteristics are summarized.

45912 **(DOE/NASA—0354-2) Wind turbine generator interaction with conventional diesel generators on Block Island, Rhode Island. Volume II. Data analysis.** Wilreker, V.F.; Stiller, P.H.; Scott, G.W.; Kruse, V.J.; Smith, R.F. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Systems Technology Div.). Feb 1984. Contract AI01-76ET20320. 138p. (NASA-CR—168319). NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84016961.

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In order to assess the performance of a MOD-OA horizontal axis wind turbine when connected to an isolated diesel utility, a comprehensive data measurement program was conducted on the Block Island Power Company installation on Block Island, Rhode Island. This report presents the detailed results of that program focusing on three principal areas of (1) fuel displacement (savings), (2) dynamic interaction between the diesel utility and the wind turbine, (3) effects of three modes of wind turbine reactive power control. The approximate two month duration of the data acquisition program conducted in the winter months (February into April 1982) revealed performance during periods of highest wind energy penetration and hence severity of operation. It is concluded that even under such conditions fuel savings were significant resulting in a fuel reduction of 6.7% while the MOD-OA was generating 10.7% of the total electrical energy. Also, electrical disturbance and interactive effects were of an acceptable level.

45913 **(DOE/SF/11611—T1) Wind-powered electric generation runway lighting system demonstration project. Interim final technical report, September 15, 1981-December 15, 1983.** Mesa, D. (California State Dept. of Transportation, Sacramento (USA). Div. of Aeronautics). Jan 1984. Contract FG03-81SF11611. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84014962.

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The project is a small scale demonstration project to determine the feasibility of using wind-powered generation of electricity to operate the runway lighting system at Half Moon Bay Airport. The airport is located in San Mateo County near Highway 1, approximately 15 miles south of San Francisco, California. The project is a joint effort of San Mateo County, the California Department of Transportation, Division of Aeronautics, and the United States Department of Energy. The concept of wind-powered turbines to produce electrical power, which is not new or unique, has been demonstrated many times. This project seeks to determine if wind power has practical application to an airport environment as a cost-effective means of providing an alternate source of energy. Should the results of this demonstration be positive, the technology can be applied to airports statewide which possess the meteorological conditions conducive to wind power generation. Concurrently included in the demonstration project, and funded separately, is the construction of a runway lighting system designed for low energy use. The total system is tied into PG & E's grid system.

45914 **(NMERDI—2-68-2214) Wind system interconnected with Lea County Electric Cooperative at Lovington, New Mexico. Final report.** Schoenmackers, R. (New Mexico Solar Energy Inst., Las Cruces (USA)). Aug 1984. 156p. NTIS, PC A08/MF A01; 1 - NMERDI, Univ. of New Mexico, Suite M, 457 Washington S.E.; Albuquerque, NM 87108. File Number DE84901651.

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A 25-kilowatt Carter wind generator was installed during August 1981 at Lovington, New Mexico. The wind generator is owned and operated by the Lea County Electric Cooperative (LCEC). The New Mexico Solar Energy Institute (NMSEI) assisted LCEC in the site selection, wind generator selection, and installation of the wind system. Since its installation, NMSEI has been monitoring the performance of the wind generator. The wind generator has worked for most of the period since August 1981. The failures of a gearbox bearing, the electronic controls, the teetering bearings, and a few minor problems caused a downtime of 15.8 percent between August 1981 and December 1983. Replacements and repairs were done by Carter Wind Systems in an efficient and timely manner. The wind generator has produced a total of 38,915 kilowatt hours since its installation. The average capacity factor was 8.8 percent. Wind speed at the site averaged about 9.2 miles per hour between August 1981 and June 1983. A data acquisition system was installed to monitor the performance of the wind generator. The data acquisition system used an Apple II computer, which measured the wind speed and direction, wind generator power output, and ambient temperature. Diurnal distributions, power curves, and monthly and daily performance data were obtained. Wind speed frequency distributions were collected and are presented.

45915 **(PNL—4864) Development and verification of MOD-2 and MOD-0A simulation models.** Miller, A.H.; Formica, W.J. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 171p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE84017389.

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This report presents a method for generating annual energy production estimates: computer models that simulate the operation and power output of the MOD-2 and MOD-0A wind turbines. These simulation models were initially conceived to identify the effects of wind variability over space and time scales and thus to pinpoint whether wind speed and direction forecasting techniques were adequate for wind turbine operations. However the verification of the models, performed using data from actual wind turbine sites, shows that they can be applied as tools in assessing the feasibility of wind energy in a particular situation.

45916 **(PNL—4900) Verification of hourly forecasts of wind turbine power output.** Wegley, H.L. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017176.

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A verification of hourly average wind speed forecasts in terms of hourly average power output of a MOD-2 was performed

for four sites. Site-specific probabilistic transformation models were developed to transform the forecast and observed hourly average speeds to the percent probability of exceedance of an hourly average power output. (This transformation model also appears to have value in predicting annual energy production for use in wind energy feasibility studies.) The transformed forecasts were verified in a deterministic sense (i.e., as continuous values) and in a probabilistic sense (based upon the probability of power output falling in a specified category). Since the smoothing effects of time averaging are very pronounced, the 90% probability of exceedance was built into the transformation models. Semiobjective and objective (model output statistics) forecasts were made compared for the four sites. The verification results indicate that the correct category can be forecast an average of 75% of the time over a 24-hour period. Accuracy generally decreases with projection time out to ~ 18 hours and then may increase due to the fairly regular diurnal wind patterns that occur at many sites. The ability to forecast the correct power output category increases with increasing power output because occurrences of high hourly average power output (near rated) are relatively rare and are generally not forecast. The semiobjective forecasts proved superior to model output statistics in forecasting high values of power output and in the shorter time frames (1 to 6 hours). However, model output statistics were slightly more accurate at other power output levels and times. Noticeable differences were observed between deterministic and probabilistic (categorical) forecast verification results.

45917 **Modeling stochastic wind loads on vertical axis wind turbines.** Veers, P.S. (Sandia National Labs., Albuquerque, NM). pp 200-210 of Structures, structural dynamics and materials conference. New York, NY; American Institute of Aeronautics and Astronautics (1984). (CONF-8405127—). Contract AC04-76DP00789.

From 25. AIAA/ASME/ASCE/AHE structures, structural dynamics and materials conference; Palm Springs, CA, USA (14 May 1984).

The Vertical Axis Wind Turbine (VAWT) is a machine which extracts energy from the wind. Since random turbulence is always present, the effect of this turbulence on the wind turbine fatigue life must be evaluated. This problem is approached by numerically simulating the turbulence and calculating, in the time domain, the aerodynamic loads on the turbine blades. These loads are reduced to the form of power and cross spectral densities which can be used in standard linear structural analysis codes. The relative importance of the turbulence on blade loads is determined. 12 references.

45918 **Status of Boeing wind-turbine systems.** Lowe, J.E.; Wiesner, W. (Boeing Engineering Co., Seattle, WA). *IEE (Institution of Electrical Engineers) Proceedings, Part A: Physical Science; Measurement and Instrumentation; Management and Education; Reviews;* **130**: 531-536(Dec 1983).

The U.S. Department of Energy's MOD-2 wind turbine program has resulted in the design, fabrication and installation of five 2.5-MW units: three at Goldendale, WA, one at Medicine Bow, WY, and one in Solano County, CA which has been sold to a major utility. The five units have operated on-line for over 4200 hours, and generated over 5,000,000 kWh of energy. The follow-on MOD-5B program for the production of a third generation multimegawatt machine will incorporate the operational and test experience obtained with the MOD-2 test turbines, in order to yield an economical and highly reliable wind turbine for utility use.

45919 **Development of the 7.3 MW MOD-5A wind-turbine generator system.** Barton, R.S.; Lucas, W.C. (General Electric Co., King of Prussia, PA). *IEE (Institution of Electrical Engineers) Proceedings, Part A: Physical Science; Measurement and Instrumentation; Management and Education; Reviews;* **130**: 537-541(Dec 1983).

The General Electric Company Advanced Energy Programs Department is designing, under DOE/NASA sponsorship through Contract DEN 3-153, the MOD-5A wind-turbine system, which must generate electricity for less than 3.75 cents/kWh (1980 dollars). During the conceptual and preliminary design phases, the basic features were established as a result of tradeoff and optimization studies driven by minimizing the system cost of energy. During the past year, the program has been in the final design phase, and a reassessment to minimize risk has received strong emphasis in the design process. The program has progressed to the point that an agreement of sale has been reached for the first unit.

45920 **Performance of tornado-type wind turbines with radial inflow supply.** Hsu, C.T.; Ide, H. (Iowa State Univ., Ames, IA). *Journal of Energy;* **7**: No. 6, 452-453(Nov 1983).

Wind tunnel tests were conducted for the performance of tornado-type wind turbines (TTWT) with radial inflow supply from incoming wind. It was shown that the radial inflow supply was necessary for intensifying a vortex in the wind collecting tower and, consequently, for enhancing the power efficiencies, C /SUB p/, of the wind turbines. Maximum C /SUB p/ (based on turbine disk area) of 3.8 and 9 was obtained for circular- and spiral-shaped towers, respectively, as compared to 0.4 for conventional windmills. With the radial inflow supply, the maximum C /SUB p/ was increased about 100% for the circular model but only 15-30% for the spiral model since the spiral model provides the inflow effect by itself.

45921 **Power coefficient of tornado-type wind turbines.** Rangwalla, A.A.; Hsu, C.T. (Iowa State University, Ames, Iowa). *Journal of Energy;* **7**: No. 6, 735-737(Nov 1983).

In a tornado-type wind turbine the wind collecting tower is equipped with adjustable vanes that can be opened on the windward side and closed on the leeward side. The wind enters the tower tangentially through these open vanes and exits from the top. As a result, a vortex is formed inside the tower. A vertical axis turbine which is located underneath the tower floor admits air vertically and exhausts it into the vortex core. The pressure drop in the vortex core can be high, depending upon the vortex concentration, thus enhancing manyfold the total pressure drop across the turbine. The power coefficient C /SUB p/ of this system depends mainly on how low a pressure can be created in the vortex core. A maximum C /SUB p/ of about 2.5 was obtained by Yen for a spiral shaped tower. This is about 6.25 times the C /SUB p/ of conventional windmills. Analytical studies have been carried out by several investigators to study the C /SUB p/ of this vortex machine. Loth considered the conservation of angular momentum and obtained a C /SUB p/ based on the tower frontal area, which is not impressive.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 20010045308, 45391, 46013, 46036, 46036, 46431, 46433

45922 (CONF-8203178—, pp 75-77) **Dual-purpose power plants.** Lederer, J. Jul 1982. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number TI84770366.

From 10. Salzburg economic inquiry; Salzburg, Austria (4 Mar 1982).

Mode of function, structure, energetic and economic advantages of dual-purpose power plants are summarized. The conservation of primary energy using dual-purpose power plants in the Land Salzburg in Austria is roughly calculated.

45923 **(DOE/CE/30886—1) Research and development of advanced concepts in electric generating plant control.** (Drexel Univ., Philadelphia, PA (USA); Philadelphia Electric Co., PA (USA)). Mar 1983. Contract AC01-78CE30886. 722p. NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE84017157.

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This report describes the development and operation of a 54th order (76th order with control system) model of a 600 MW coal-fired power plant. The model is comprised of a furnace (gas and steam side), feedwater system, turbine, generator, and a conventional control system. Also included are several transient cases run with the model as well as data for initializing the model at sev-

eral load levels from full load down to 30%. Results of a modal analysis and comments on observability and controllability are also presented. A complete program listing (in both DSL and FORTRAN), cross-reference, and variable description are also included.

45924 **(MTR—79W00249) Gasification combined cycles for electric utility power.** Larson, J.W.; Boyum, W.B.; Lewis, J.P. (Mitre Corp., McLean, VA (USA). METREK Div.). Jul 1979. Contract AC01-78ET10425. 82p. NTIS, PC A05/MF A01; GPO Dep. File Number DE84012987.

The idea of a combined cycle power plant integrated with a coal gasification process has attracted broad interest in recent years. This interest is based on unique attributes of this concept which include potentially low pollutant emissions, low heat rate and favorable economics as compared to conventional steam plants with stack gas scrubbing. Results from a survey of technical literature containing preformance and economic predictions have been compiled for comparison and evaluation of this new technique. These performance and economic results indicate good promise for near-term commercialization of an integrated gasification combined cycle power plant using current gas turbine firing temperatures. Also, these data show that advancements in turbine firing temperature are expected to provide sufficiently favorable economics for the concept to penetrate the market now held by conventional steam power plants.

45925 **Failure modes and effects analysis of a high-temperature gas turbine in an integrated gasification combined cycle.** Horner, M.W.; Zahran, A.S.; Manning, G.B. *Proceedings, Intersociety Energy Conversion Engineering Conference;* 17: vp(1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Paper 829072.

A failure mode, effects, and criticality analysis (FMECA) of an integrated combined-cycle/gasification power plant identified single failure points within the plant design and determined the criticality (impact) of each hypothetical failure on plant performance. The results led to an updated plant design and a second FMECA for steady-state (baseload) plant operation. A final analysis of the top level start-up sequence established the system baseline for future designs. The initial fault-tree analysis followed by the FMECA very effectively improved the system design, minimizing the impact of potential failures on plant performance and raising the plant's operating reliability. According to the analytical results, the integrated scheme is a viable and reliable means of converting coal to electric power.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 20020045364, 45365, 45366, 45367, 45374

45926 **(DOE/FE—60181-73) Influence of coal-specific fly ash properties upon baghouse performance: a comparison of two extreme examples.** Miller, S.J.; Sears, D.R. (North Dakota Univ., Grand Forks (USA). Energy Research Center). 1984. Contract FC21-83FE60181. 24p. (CONF-840859—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016952.

From 5. symposium on the transfer and utilization of particulate control technology; Kansas City, MO, USA (27 Aug 1984).

Pilot plant data with a large number of lignite and subbituminous coals have demonstrated that shaker baghouse efficiency is highly coal specific with large differences in baghouse penetration for different coals. A previous report has presented these findings along with an observed correlation between elemental fly ash composition and baghouse penetration. This paper presents a further investigation of the relationship between fly ash properties and baghouse penetration with woven glass fabric and shaker cleaning. The focus will be on two coals which represent the good and poor extremes of filter performance. The coal and ash properties of a lignite showing good filter performance are compared with the properties of a lignite demonstrating very poor performance. An examination of both chemical and physical ash properties which include elemental compositions as a function of size, particulate size distribution, particle surface morphology, and other physical descriptors is presented in an attempt to determine causes of grossly different baghouse performance. The work described in this paper was not funded by the US Environmental Protection Agency and therefore the contents do not necessarily reflect the views of the Agency and no official endorsement shoud be inferred. 12 references.

2003 Power Transmission And Distribution

45927 **(EPRI-EL—3502) Development of a nonfragmenting distribution surge arrester. Final report.** Koch, R.E. (General Electric Co., Pittsfield, MA (USA). Large Transformer Business Div.). Aug 1984. 184p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920476.

This report describes the investigation and testing carried out in the development of a nonfragmenting distribution surge arrester. It is commonly assumed that pressure buildup in a failing surge arrester will cause the porcelain to burst unless the pressure is rapidly relieved. Even after pressure relief, however, the porcelain can shatter from the thermal shock produced by the internal arc. There is little published information on the sequence of events during failure and the relative importance of pressure and thermal stress. A prerequisite for the design of a nonfragmenting arrester is a thorough knowledge of the failure mechanism. Extensive testing was performed to determine the contribution of both pressure and heat to porcelain breakage. This research demonstrated the importance of thermal shock and led to the design of an ablative thermal shield for the porcelain housing. This was combined with pressure relief provided by end-cap venting and a retaining system to prevent ejection of internal parts. The final result was the design and production of nonfragmenting distribution arresters rated 9 kV through 27 kV.

45928 **(EPRI-EL—3624) Designer's handbook for forced-cooled high-pressure oil-filled pipe-type cable systems. Final report.** Purnhagen, D.W. (Underground Systems, Armonk, NY (USA)). Jul 1984. 217p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920474.

This handbook provides the necessary tools for the engineer to design forced-cooled HPOF pipe-type cable systems. It represents the final objective of a major project which included an extensive research program at the Waltz Mill Forced-Cooling Test Facility. The formulas and procedures presented in this handbook are consistent with the results of this program as well as other full-scale and model investigations. Introductory material, including historical information, general design concepts and basic heat transfer and fluid dynamics theory is given for those who are unfamiliar with the fundamental principles of forced-cooling. The nucleus of the handbook consists of equations and calculating procedures for determining forced-cooled parameters and thermal/hydraulic performance levels. Both simple and sophisticated procedures have been provided, with the more complex procedures treating such areas as the thermal interaction between cable pipes as well as the transient aspects of forced-cooling. A section on applications is also provided which gives practical guidelines for the implementation of forced-cooling equipment and the overall engineering of forced-cooled cables. Components such as heat exchangers, pumps and refrigeration equipment are discussed with respect to performance and environmental impact. The cable and accessories are also characterized. Cost factors are estimated for the major components and their energy usage is defined. Finally, guidelines for integrating the components for a total system design are presented.

21 NUCLEAR POWER PLANTS

45929 **(NUREG—0020-Vol.8-No.7) Licensed operating reactors. Status summary report, data as of 6-30-84. Volume 8, No. 7.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Aug 1984. 387p. NTIS, PC A17/MF A01 - GPO. File Number TI84901831.

This monthly report provides data on the operation of nuclear units as timely and accurately as possible. This report is divided into three sections: the first contains monthly highlights and statis-

tics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States. The percentage computations, the vendor capacity factors, and actual vs potential energy production are computed using actual data for the period of consideration. The percentages listed in power generation are computed as an arithmetic average. The factors for the life-span of each unit (the Cumulative column) are reported by the utility and are not entirely re-computed by NRC. Utility power production data are checked for consistency with previously submitted statistics.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 21010045974, 45990, 45995, 45996, 46000, 46001, 46004, 46005, 46007, 46008, 46015, 46016, 46017, 46019, 46027, 46031, 46033

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO C.TATION(S) 21020045632, 45974, 45983, 45991, 45993, 45994, 45996, 45999, 46004, 46005, 46006, 46007, 46008, 46015, 46016, 46017, 46019, 46022, 46025, 46026, 46028, 46032, 46033, 47007

45930 (CEN—202(V)-NP) **Comprehensive vibration assessment program for the prototype system 80 reactor internals. (Palo Verde Nuclear Generating Station Unit 1).** (Combustion Engineering, Inc., Windsor, CT (USA)). 1984. 239p. NTIS, PC A15/MF A01. File Number DE84901860.

In accordance with the United States Nuclear Regulatory Commission Regulatory Guide 1.20 (Rev. 2) a Comprehensive Vibration Assessment Program (CVAP) has been developed for Palo Verde Nuclear Generating Station Unit 1. Purpose of the CVAP is to verify the structural integrity of the reactor internals to flow induced loads prior to commercial operation. The dynamic flow related loads considered are associated with normal steady state operation and anticipated operating transients. This comprehensive program, for a reactor prototype, consists of four individual Analysis, Measurement, Inspection, and Evaluation programs. The Analysis program provides theoretical evidence of the structural integrity of the internals and serves as a basis for both the Measurement and Inspection programs. Results of these programs form a basis for assessing, in the Evaluation program, the margin of safety for the reactor internals. This report contains a summary of the Analysis program and descriptions of the Measurement and Inspection programs.

45931 (INIS-mf—9040, pp 268-269) **Carbon-14 ion exchange resins from Finnish nuclear power plants.** Snellman, M. (Valtion Teknillinen Tutkimuskeskus, Helsinki (Finland)); Salonen, L. (Institute of Radiation Protection, Helsinki (Finland)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45932 (NUREG/CR—1982) **Eddy-current inspection for steam generator tubing program. Quarterly progress report for period ending September 30, 1980.** Dodd, C.V.; Deeds, W.E.; McClung, R.W. (Oak Ridge National Lab., TN (USA)). Apr 1981. Contract AC05-84OR21400. 11p. (ORNL/NUREG/TM—441). NTIS, PC A02/MF A01 - GPO. File Number TI84017626.

Eddy-current methods provide the best in-service inspection of steam generator tubing, but present techniques can produce ambiguity because of the many independent variables that affect the signals. The current development program has used mathematical models and developed or modified computer programs to design optimum probes, instrumentation, and techniques for multifrequency, multiproperty examinations. Interactive calculations and experimental measurements have been made with the use of modular eddy-current instrumentation and a minicomputer. These establish the coefficients for the complex equations that define the values of the desired properties (and the attainable accuracy) despite changes in other significant variables. The computer programs for calculating the accuracy with which various properties can be measured indicate that the tubing wall thickness and the defect size can be measured much more accurately than is currently required, even when other properties are varying. Our experimental measurements have confirmed these results. We have designed and constructed instrumentation systems and are making necessary improvements for use in the field.

45933 (NUREG/CR—3692) **Possible modes of steam generator overfill resulting from control system malfunctions at the Oconee-1 nuclear plant.** Clark, F.H.; Clapp, N.E.; Broadwater, R. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 54p. (ORNL/TM—9061). NTIS, PC A04/MF A01 - GPO. File Number TI84015503.

A study has been made of control system failures which might lead to overfill of the steam generator in Babcock and Wilcox nuclear plants. The steam generator and its control system are described. Only one sequence has been found in which a single failure would lead to overfill, and in that case the final stages of the overfill would proceed rather slowly. Because of high level protective features all other failure sequences we have examined require at least two failures to produce overfill beyond the point of high level protection. Several sequences are described in which high level protection features can be placed in an undetected failed state by a control system failure; a subsequent additional failure, occurring prior to the detection and correction of the first failure, could then produce system overfill. Mechanical damage is identified which might be consequent upon steam generator overfill and water entry into the main steam line. Several ways of reducing the probability of steam generator overfill are suggested. No assessment has been made of the probability of occurrence of any of the sequences.

45934 (NUREG/CR—3822) **SOLA-PTS: a transient, three-dimensional algorithm for fluid-thermal mixing and wall heat transfer in complex geometries.** Daly, B.J.; Torrey, M.D. (Los Alamos National Lab., NM (USA)). Jul 1984. Contract W-7405-ENG-36. 99p. (LA—10132-MS). NTIS, PC A05/MF A01 - GPO. File Number TI84017113.

The SOLA-PTS computer code has been developed to analyze fluid-thermal mixing in the cold legs and downcomer of pressurized water reactors in support of the pressurized thermal shock study. SOLA-PTS is a transient, three-dimensional code with the capability of resolving complex geometries using variable cell noding in the three coordinate directions. The computational procedure is second-order accurate and utilizes a state-of-the-art iteration method that allows rapid convergence to an accurate solution for the pressure field. Two different turbulence models are used in the code, a two-equation k-ϵ model that is used in the cold leg pipe away from the HPI inlet and a three-equation k-ϵ-T'^2 model for use near the HPI inlet and in the downcomer. The physical modeling and the numerical procedure used in SOLA-PTS are described in this report. Applications of the method to two Creare 1/5th-scale experiments are also presented. Two appendices are included which provides a comparison of the two- and three-equation turbulence models, and instructions for setting up and running a problem with SOLA-PTS.

45935 **COBRA-TF grid spacer heat transfer models.** Kelly, J.M.; Hochreiter, L.E.; Loftus, M.J.; Paik, C.Y. (Battelle-Pacific Northwest Laboratory, P.O. Box 999, Richland, WA 99352). *Transactions of the American Nuclear Society;* **46**: 842-844(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45936 **Assessment of TRAC and RELAP5 codes with ORNL post-CHF tests.** Rohatgi, U.S.; Neymotin, L.; Pu, J. (Brookhaven National Laboratory, Upton, NY 11973). *Transactions of the American Nuclear Society;* **46**: 820-821(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45937 **In-core coolant velocity measurements in a pressurized water reactor using temperature-neutron noise cross-correlation.** Sweeney, F.J. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **46**: 736-738(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45938 **Influence of fuel vibration on PWR neutron noise associated with core barrel motion.** Sweeney, F.J.; March-Leuba, J. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **46**: 734-735(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45939 **Evaluation of selected approximations used in pressure vessel fluence calculations.** Todosow, M.; Carew, J.F.; Kohut, P. (Brookhaven National Laboratory, Upton, NY 11973). *Transactions of the American Nuclear Society;* **46**: 658-659(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45940 **Benchmarking of pressure vessel fluence calculations.** Cokinos, D.M.; Carew, J.F.; Kohut, P.; Todosow, M. (Brookhaven National Laboratory, Upton, NY 11973). *Transactions of the American Nuclear Society;* **46**: 636-637(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45941 **Neutron calculations of the two-year irradiation experiment at the ORR-PSF and comparison with measurements.** Maerker, R.E.; Worley, B.A. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **46**: 634-636(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 21030046224

45942 **(CONF-840848—9) Irradiation performance of pyrolytic silicon carbide coatings on fissile fuel particles.** Lauf, R.J. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016545.

From 42. annual Electron Microscopy Society of America meeting; Detroit, MI, USA (13 Aug 1984).

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Fuel particles for the High Temperature Gas-Cooled Reactor (HTGR) contain a layer of pyrolytic silicon carbide to act as a miniature pressure vessel and primary fission product barrier. Optimization of the SiC coating with respect to fuel performance involves four areas of study: (a) characterization of as-deposited SiC coatings; (b) thermodynamics and kinetics of chemical reactions between SiC and fission products; (c) irradiation behavior of SiC in the absence of fission products; and (d) the combined effects of irradiation and fission product interactions. This paper reports the behavior of SiC deposited on fissile fuel particles and irradiated to fast neutron fluences typical of HTGR fuel at end-of-life.

45943 **(ORNL/TM—8977) Phase I measurements for the HTGR bottom reflector and Core Support Block Neutron-Streaming Experiment.** Muckenthaler, F.J.; Holland, L.B.; Hull, J.L.; Manning, J.J. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84016555.

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This report presents the Phase I measurements of the High-Temperature Gas-Cooled Reactor Bottom Reflector and Core Support Neutron Streaming Experiment conducted at the ORNL Tower Shielding Facility during FY-1983. In this phase the first four of eight segments that comprise the full experimental mockup were utilized. These were: (1) an upper boron pin layer (graphite matrix) followed by a boral shroud; (2) a graphite reflector layer; (3) a graphite coolant crossover layer; and (4) a graphite follow-on layer, all containing coolant holes. A collimated beam from the Tower Shielding Reactor II was used as the neutron source. In order to obtain a spectrum of neutrons more nearly like the spectrum expected from the HTGR, an iron and graphite spectrum modifier was inserted in the TSR-II beam ahead of the experimental mockup. The various experimental configurations tested resulted from the successive addition of the four graphite layers to the mockup. Neutron energy spectra were measured behind the spectrum modifier and the boron pin layer and integral neutron fluxes were measured behind the spectrum modifier and behind each of the four layers. The measurements were divided into two Parts, the two parts differing in the composition of the boron pin layer. During part I, a reference pin pattern was used which consisted of a combination of graphite and boronated graphite pins. During part II, a full pattern of boronated graphite pins was used. The experimental data are presented in both tabular and graphical form.

45944 **(ORNL/TM—9030) Multigrid iteration solution procedure for solving two-dimensional sets of coupled equations.** Vondy, D.R. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84016554.

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A procedure of iterative solution was coded in Fortran to apply the multigrid scheme of iteration to a set of coupled equations for solving two-dimensional sets of coupled equations. The incentive for this effort was to make available an implemented procedure that may be readily used as an alternative to overrelaxation, of special interest in applications where the latter is ineffective. The multigrid process was found to be effective, although not always competitive with simple overrelaxation. Implementing an effective and flexible procedure is a time-consuming task. Absolute error level evaluation was found to be essential to support methods assessment. A code source listing is presented to allow simple application when the computer memory size is adequate, avoiding data transfer from auxiliary storage. Included are the capabilities for one-dimensional rebalance and a driver program illustrating use requirements. Feedback of additional experience from application is anticipated.

45945 **(ORNL/TM—9252) Analysis of Phase I of the HTGR bottom reflector and core support block neutron-streaming experiment.** Slater, C.O. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 109p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84017632.

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The Phase I measurements, which used the Tower Shielding Reactor II neutron beam as a source, comprise the first of two series of measurements on an experimental configuration mocking up various regions of the graphite reflector and support structure below a seven-column region of the HTGR core. The analysis of the Phase I study consisted of predictions of the detector responses behind the various segments of the experimental configuration. The predictions were based on neutron transport calculations with the two-dimensional discrete ordinates code DOT (using both homogeneous and heterogeneous models) and the three-dimensional Monte Carlo code MORSE. Calculated results agreed with the measured

results within +- 20%. The Phase I measurements and accompanying analysis yielded streaming factors up to a factor of 5 for thermal neutrons transported through the boron pin segment. They also showed that doubling the amount of boron in the segment reduced the thermal-neutron flux directly behind the boron pin layer by a factor of about 2.2. However, the increased boron loading was less effective as other segments were added to the experimental configuration, the difference being only about 30% behind the last (fourth) segment. With the lower boron pin loading, the maximum estimated neutron streaming factors for the Phase I experimental configuration were calculated to be about 17 for E > 0.1 MeV; 21 for 950 eV < E < 0.1 MeV; 10 for 0.4 EV < E < 950 eV; and 3 for E < 0.4 eV.

45946 **Analysis of phase 1 of the ORNL HTGR bottom reflector and support block neutron streaming experiment.** Slater, C.O. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **46**: 637-638(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 21040045980, 45981

45947 (INIS-mf—9040, pp 270-272) **Overview of the Ontario Hydro carbon-14 control program.** Stasko, R.R.; Vivian, G.A. (Ontario Hydro, Toronto (Canada)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 21050046006, 46011, 46029, 46030, 46188

45948 **EBR-II fuel handling transfer arm repair.** Cerchione, J.D.; Buschman, H.W. (Argonne National Laboratory, P.O. Box 2528, Idaho Falls, ID 83401). *Transactions of the American Nuclear Society;* **46**: 780-782(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45949 **CAT reconstruction and potting comparison of an LMFBR fuel bundle.** Betten, P.R.; Tow, D.M. (Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **46**: 779-780(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45950 **Potting and sectioning of fuel bundles at HFEF.** Webb, J.P.; Carlson, B.G. (Argonne National Laboratory, P.O. Box 2528, Idaho Falls, ID 83401). *Transactions of the American Nuclear Society;* **46**: 778-779(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45951 **Radial heat transfer calculations for a potted solid matrix embedded subassembly.** Betten, P.R. (Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **46**: 799-800(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45952 **Long-term post test simulation of the FFTF natural circulation tests using SSC.** Horak, W.C.; Guppy, J.G.; Kennett, R.J. (Brookhaven National Laboratory, Upton, NY 11973). *Transactions of the American Nuclear Society;* **46**: 798-799(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45953 **Thermal laminarization of a stratified pipe flow.** Oras, J.J.; Kasza, K.E. (Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **46**: 792-794(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45954 **Mitigation of thermal transients by tube bundle inlet plenum design.** Oras, J.J.; Kasza, K.E. (Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **46**: 791(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45955 **LMFBR neutronics calculations with the Los Alamos class VI computers.** LaBauve, R.J.; England, T.R.; George, D.C.; MacFarlane, R.E.; Wilson, W.B. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **46**: 725-726(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45956 **The maintenance viewpoint of a successful reactor startup program.** Moffitt, W.C.; Grygiel, M.L. (Westinghouse Electric Corporation, Hanford Engineering Development Laboratory, P.O. Box 1970, Richland, WA 99352). *Transactions of the American Nuclear Society;* **46**: 611-612(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45957 **(RISLEY-Trans—4156-T) Description of test sections for local boiling in the Compact Sodium Boiling Loop (KNS).** Huber, F.; Jenes, E.; Mattes, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Sep 1982. Translation of KFK-2475, April 1978. 79p. NTIS (US Sales Only), PC A05/MF A01. File Number DE84901843.

Within the R and D program associated with the building of SNR 300, local coolant perturbations in large pin-bundle geometries have been investigated experimentally under conditions similar to those in the reactor. Two test sections have been constructed for this purpose, geometrically and thermohydraulically similar to an SNR 300 sub-assembly. Test Section 1 has a central 49% blockage and Test Section 2, a corner blockage of approximately 21%. This report gives a comprehensive description of both test sections and considers the construction and instrumentation in particular detail.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

REFER ALSO TO CITATION(S) 21060045988

45958 **Nuclear reactor sources for space prime propulsion and power.** Myrabo, L.N.; Powell, J.R. (BDM Corp., McLean, VA). pp 405-424 of Orbit-raising and maneuvering propulsion: research status and needs. New York, NY; American Institute of Aeronautics and Astronautics (1984).

A brief review is given of U.S. space nuclear reactors developed during a 16-year period before cancellation of the program in 1972 due to a change in mission orientation. Characteristics of nuclear reactor sources suitable for space prime propulsion and power applications for near earth missions are described. With realistically

achievable modifications, near-term gas-cooled (solid core or particle bed) nuclear rocket technology could be applied to the development of open- or closed-cycle reactor power plants which produce tens to hundreds of MWe. In the far term, very high temperature gas core reactor technology could enable ultra-performance, high power density closed-cycle space power plants. 20 references.

45959 **Nuclear space power systems for orbit raising and maneuvering.** Buden, D.; Sullivan, J.A. (Los Alamos National Lab., NM). pp 425-459 of Orbit-raising and maneuvering propulsion: research status and needs. New York, NY; American Institute of Aeronautics and Astronautics (1984).

Reference is made to recent studies which have shown that direct thrust nuclear rockets for routine orbit raising and near-earth space tug missions are probably not cost-effective. The need for additional trade-off studies and comparisons of direct-thrust nuclear systems with chemical systems to clarify the role of nuclear rockets in missions requiring rapid orbit maneuvering is stressed. Attention is confined here to nuclear electric propulsion considerations. Low-mass nuclear power plants are constructed to optimize nuclear electric propulsion systems. Electric power levels from 100 kilowatts to as much as several megawatts are desirable. The goals for the power plant specific mass are 20-30 kg/kW at the lower powers to 2-4 kg/kW at the higher powers.

45960 **Particle bed reactors for space power and propulsion.** Powell, J.R.; Botts, T.E. (Brookhaven National Lab., Upton, NY). pp 495-525 of Orbit-raising and maneuvering propulsion: research status and needs. New York, NY; American Institute of Aeronautics and Astronautics (1984).

Compact, high power, high temperature nuclear reactors based on the use of small diameter (approximately 0.5 mm) high temperature gas-cooled reactor (HTGR) particulate fuel are investigated for propulsion applications. The particulate fuel has very high heat transfer area (approximately 100 sq cm per cu cm of bed), allowing very high power densities (megawatts per liter) and relatively small temperature differences (approximately 10 K) between fuel and the gas coolant. Two high performance reactor designs are described. The FBR (Fixed Bed Reactor) uses a closed cycle, high efficiency inert gas Brayton power cycle to generate power for electric thrusters. The RBR (Rotating Bed Reactor) uses an open cycle hydrogen cooled design, and generates approximately 3000 K gases for direct thrust at a specific impulse of approximately 1000 s. 7 references.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 21070045583, 45999, 46013

45961 **(NUREG—0540-Vol.6-No.6) Title list of documents made publicly available June 1-30, 1984. Volume 6, No. 6.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Aaug 1984. 709p. NTIS, PC A99/MF A01 - GPO*. File Number TI84901827.

The Title List of Documents Made Publicly Available is a monthly publication. It contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes: (1) docketed material asociated with civilian nuclear power plants and other uses of radioactive materials; and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index.

45962 **(NUREG—0750-Vol.19-No.4) Nuclear Regulatory Commission issuances. Vol. 19, No. 4.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Apr 1984. 222p. NTIS, PC A10/MF A01 - GPO*. File Number TI84901879.

This report includes the issuances received during April 1984 from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

2108 Economics

REFER ALSO TO CITATION(S) 21080046079, 46098

45963 **Nuclear capacity expansion in Mexico: system effects of reactor size and cost.** Thayer, G.R.; Abbey, D.S.; Enriquez, R.P.; Hardie, R.W.; Uria, E.G. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **46**: 595-596(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 22010047007

45964 **(HW—31999) Exponential pile measurements in graphite-uranium lattices.** Clayton, E.D. (General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation). 1 Jun 1954. Contract AC06-76RL01857. 107p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84016685.

Portions are illegible in microfiche products.

This paper gives the results from a series of exponential experiments involving thirty graphite-uranium lattices. In these measurements, the diameter of the slug was varied from 0.925" to 1.66", and measurements were also taken with one hollow slug (1.66" O.D., 0.81" I.D.). The lattice spacing was varied from 6-3/16" to 15". Both wet and dry lattice measurements were taken; that is, the lattices were measured with water and without water in the cooling annulus to determine the effect of the cooling water on the buckling or reactivity. The lattice diffusion lengths, utilization in the moderator, utilization in uranium, and multiplication constant are also listed for those lattices in which these quantities were determined, which includes all of the above with the exception of the hollow slug and the 12-3/8" and 15" lattice spacings with the 1.66" solid slug. Calculated conversion ratios are given for all except the hollow slug size.

45965 **Verification of the Los Alamos theory of the prompt fission neutron spectrum.** Madland, D.G.; LaBauve, R.J. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **46**: 760-763(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45966 **Improved (n,f) cross sections using measured fission probabilities.** Arthur, E.D. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **46**: 759-760(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45967 **A theory of the fission-source-driven neutron noise field.** Difilippo, F.C. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **46**: 738-739(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45968 **Monte Carlo mean activation time in finite water systems.** Schmidt, E.; Rose, P.F. (Brookhaven National Laboratory, Upton, NY 11973). *Transactions of the American Nuclear Society;* **46**: 732-733(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45969 **Vectorized Monte Carlo applications in reactor physics analysis.** Brown, F.B.; Mendelson, M.R. (Knolls Atomic Power Laboratory, P.O. Box 1072, Schenectady, NY 12301). *Transactions of the American Nuclear Society;* **46**: 727-728(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45970 **CINDER-3: Depletion code for class VI computers.** Wilson, W.B.; England, T.R.; LaBauve, R.J.; Schenter, R.E. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **46**: 724-725(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45971 **Streaming in lattices.** Gelbard, E.M. (Argonne National Laboratory, 9700 South Cass Ave., Argonne, IL 60439). pp 223-400 of Advances in nuclear science and technology. Vol. 15. Lewins, J.; Becker, M. New York, NY; Plenum Publishing Corp. (1983).

This paper focuses attention on a few areas of the literature of neutron streaming in which current research has been particularly active. Only the calculation of homogenized diffusion coefficients is treated. The study is interested in grafting the effects of streaming artificially onto the diffusion calculations run routinely in the reactor design and analysis process. The paper is concerned primarily with lattices, especially perfect lattices. Most of the work discussed is concerned with fast reactors as in fast reactors there are voided coolant channels that constitute important streaming paths, among other features. Some very basic questions concerned with the definition of homogenized diffusion coefficients are discussed. A detailed elaboration of numerical techniques for computing diffusion coefficients from some of the proposed definitions is given. Some computational techniques that may be used to help in assessing the validity of streaming calculations are also discussed.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 22020046097, 46225

45972 **(INIS-mf—8881) Fracture prevention and availability in the series safety of the pressure boundary of light water reactors. Materials for advanced reactor systems.** (Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt). 1983. 506p. (In German, English). (CONF-8310224—). NTIS (US Sales Only), PC A22/MF A01. File Number DE84780610.

From MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (13 Oct 1983).

This brochure contains the full text of 23 lectures, which were given at the 9th MPA Seminar in October 1983. The main part of the work consists of investigations of fracture mechanics of reactor steel.

45973 **(NUREG/CR—3833) Behavior of subcritical and slow-stable crack growth following a post-irradiation thermal anneal cycle.** Cullen, W.H.; Hiser, A.L. (Materials Engineering Associates, Inc., Lanham, MD (USA)). Aug 1984. 38p. (MEA—2048). NTIS, PC A03/MF A01 - GPO* $3.75. File Number TI84901828.

This report presents the experimental results of Phase I of a Small Business Innovation Research Program which investigated the response of environmentally-assisted monotonic and cyclic crack growth following a simulated anneal of a reactor-pressure vessel weld. Unirradiated steels were used in this (initial) Phase I of the program. Fatigue cracks were grown in several specimens of a submerged arc weld deposit in pressurized, high-temperature reactor-grade water. The specimens were removed from the environment, and annealed for one week at either 399°C or 454°C. Some control specimens were not annealed. Following the anneal, the specimens were divided into two lots. Fatigue crack growth in high-temperature water was resumed on one lot of annealed specimens and unannealed controls. No effect of the anneal was noted on the fatigue crack growth rates, which continued with about the same degree of environmental assistance as exhibited before tha anneal. An elastic-plastic fracture specimen tested in 93°C air at a very slow loading rate, showed that neither annealing nor the slow rate had a significant effect on the J-R curve characteristics. However, conducting the tests at a slow loading rate in 93°C PWR water resulted in a 25 to 30% decrease in J/sub Ic/ and a small decrease in T/sub avg/. Examination of the oxides on the fatigue fracture surfaces showed that some hematite formed during the anneal, but that magnetite, formed during the crack growth in pressurized, high-temperature water, was the predominant oxide specie.

45974 **(NUREG/CR—3856) Ultrasonic level and temperature sensor for power reactor applications.** Dress, W.B.; Miller, G.N. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 30p. (ORNL/TM—9236). NTIS, PC A03/MF A01 - GPO. File Number TI84015545.

An ultrasonic waveguide employing torsional and extensional acoustic waves has been developed for use as a level and temperature sensor in pressurized and boiling water nuclear power reactors. Features of the device include continuous measurement of level, density, and temperature producing a realtime profile of these parameters along a chosen path through the reactor vessel.

45975 **Thermal oscillations downstream of an elbow in stratified pipe flow.** Kuzay, T.M.; Kasza, K.E. (Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **46**: 794-796(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45976 **Long-term creep calculation of reactor containment.** Pfeiffer, P.A.; Marchertas, A.H. (Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **46**: 590-592(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45977 **Component aging illustrated in maintenance histories from IPRDS.** Kahl, W.K.; Borkowski, R.J. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **46**: 581-583(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

45978 **AE/flaw characterization for nuclear pressure vessels.** Hutton, P.H.; Kurtz, R.J.; Pappas, R.A. (Pacific Northwest Lab., Richland, WA). pp 735-743 of Review of progress in quantitative nondestructive evaluation, Vol. 3B. Thompson, D.O.; Chimenti, D.E. New York, NY, USA; Plenum Press (1984). (CONF-830811—).

From Conference on quantitative NDE; Santa Cruz, CA, USA (7 Aug 1983).

This chapter discusses the use of acoustic emission (AE) detected during continuous monitoring to identify and evaluate growing flaws in pressure vessels. Off-reactor testing and on-reactor testing are considered. Relationships for identifying acoustic emission (AE) from crack growth and using the AE data to estimate flaw severity have been developed experimentally by laboratory testing. The purpose of the off-reactor vessel test is to evaluate AE monitoring/interpretation methodology on a heavy section steel vessel under simulated reactor operating conditions. The purpose of on-reactor testing is to evaluate the capability of a monitor system to function in the reactor environment, calibrate the ability to detect AE signals, and to demonstrate that a meaningful criteria can be established to prevent false alarms. An expanded data base is needed from application testing and methodology standardization.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 22030046504

2204 Control Systems

REFER ALSO TO CITATION(S) 22040045996

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 22050045632

45979 **(INIS-mf—8797) Safety analysis and stability testing of rock strata for projected underground nuclear power plants.** Duddeck, H. (Technische Univ. Braunschweig (Germany, F.R.). Inst. fuer Statik). 1980. 126p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84780611.

The study investigates basic problems, the stability of rock structures, and a method to determine the stability of large-volume cavities in which accident consequences would be severe. Realistic safety coefficients could not be established, noteven for specific cavity types and rock classes. On the other hand, the report shows how stability analyses can be carried out for individual rock cavities. So far, the process has not been tested in practice.

45980 (INIS-mf—9040, pp 300-303) **In-plant radioactive materials pathways model to calculate radioactive emissions from CANDU PHWR plants.** Barber, D.; Van Berlo, J. (Atomic Energy of Canada Ltd., Sheridan Park, Ontario. Power Projects). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45981 (INIS-mf—9040, pp 107-108) **Radioactive liquid filter wastes handling at Darlington G.S.** Mackie, A.D.; Lo, K.K. (Ontario Hydro, Toronto (Canada)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

45982 **(YJT—84-02) Radiometric, electrical and acoustic geophysical borehole studies of the Loviisa power plant site in 1983.** Saksa, P. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Jan 1984. 62p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84702928.

The borehole geophysical methods have been utilized on the Loviisa power plant site to resolve hydrogeological conditions. Late in 1983 radiometric, electrical and acoustic logging was performed by BPB Instruments Ltd. The types of sondes employed were neutron-neutron, gamma-gamma, natural background radiation, caliper, sonic and dipmeter. Boreholes Y1, Y4, Y5, Y8 and Y11 were investigated. The results show that these methods can be applied succesfully to evaluate geomechanical parameters in crystalline bedrock environment. Especially the dipmeter and acoustic logging seem to detect efficiently possible hydraulic conductive fractures and their orientation. Radiometric methods have not a resolution high enough to localise small scale features but provides, however, valuable lithological and supplementary information of fracturing. Logs from borehole Y1 are appended to this paper. The survey provided new information of absolute fracture orientations that is important in modelling bedrock conditions in the area and to combine with results of cross-hole geophysical methods. Further processing of the results and development of interpretational models is important to utilize the discussed borehole methods in crystalline rock mass investigations.

45983 **Evaluation of pressurized water for decontamination applications.** Allen, R.P.; Gardner, H.R. (Battelle-Pacific Northwest Laboratory, P.O. Box 999, Richland, WA 99352). *Transactions of the American Nuclear Society;* **46**: 717-719(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 22060045503, 45507, 45943, 45952, 45986, 46002, 46020, 46032

45984 **(AGC—2605) Final test specifications for ground test reactor (GTR): tests of 13 July 1963.** (Aerojet-General Corp., Azusa, CA (USA)). Jul 1963. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84016837.

Portions are illegible in microfiche products.

This report covers neutron detectors, pulse preamplifier, pressure transducers, system amplifiers, and electronic components. (DLC)

45985 **(ORNL/TM—9220) Specifications for high flux isotope reactor fuel elements HFIR-FE-3.** Bowden, G.A.; Knight, R.W. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 49p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84016574.

This specification covers requirements for two types of aluminum-base fuel elements which together will be used as the fuel assembly in the High Flux Isotope Reactor (HFIR). Requirements are included for materials of construction, fabrication, assembly, inspection, and quality control to produce fuel elements in accordance with Company drawings.

2207 Plutonium And Isotope Production Reactors

45986 **(ORNL/TM—9318) High Flux Isotope Reactor quarterly report, April-June 1984.** Dahl, T.L.; Farrar, M.B. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016576.

Routine reactor operation with four end-of-cycle shutdowns, three other scheduled shutdowns, and two unscheduled shutdowns resulted in an on-stream time of 92.3% for the quarter. The inner control cylinder and the outer control plates were replaced. There were no radiological environmental or industrial-related incidents or injuries during the quarter.

2208 Propulsion Reactors

45987 **(APEX—37) Aircraft Nuclear Propulsion Department. Engineering progress report No. 37, July 1, 1960-September 30, 1960.** (General Electric Co., Cincinnati, OH (USA). Aircraft Nuclear Propulsion Dept.). Sep 1960. 151p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE84017120.

Portions are illegible in microfiche products; Declassified 3 Jun 1982.

Objective is the development of high-performance direct-air-cycle nuclear power plants suitable for the propulsion of aircraft at Mach 0.8 to 0.9 at 35,000 feet for 1000 hours. The initial step in the development of the flight power plant is the Advanced Core Test (ACT), a reactor test in the single-engine integral in-line configuration. The ACT test assembly (designated D140E1) has a ceramic reactor and X211 turbomachinery. Performance specifications and design parameters for the D140E1 are derived from the flight power plant requirements. The Advanced Core Test will demonstrate the capabilities of the ceramic reactor and associated equipment in the single-engine integral in-line power plant configuration. Major effort during the quarter has been applied to the design and development of components for the ACT D140E1 test assembly.

45988 **(BMI-X—10043) Progress on advanced high-temperature materials during March, 1963.** Chubb, W.; Dickerson, R.F. (Battelle Columbus Labs., OH (USA)). 1 Apr 1963. Contract W-7405-ENG-92. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016918.

Portions are illegible in microfiche products; Declassified 4 Sep 1973.

This program is aimed at the development of fuels and materials for high-temperature nuclear reactors. The fuel materials of immediate concern are the mixed carbides and carbide alloys based on uranium carbide. The work is not directly related to specific reactor or systems development projects, but is intended to develop basic information of direct use to engineers and metallurgists in development of advanced reactors. An area of immediate application will be the space power and propulsion programs of the Atomic Energy Commission.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 22090045979, 46211

45989 **(AECL—7536) Cost effective radiation risk management in a generic nuclear plant design.** Maan, M.A. (Atomic Energy of Canada Ltd., Sheridan Park, Ontario. Power Projects). Nov 1982. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702940.

To determine whether any further dose reduction measures are justified, a method appropriate for cost effective radiation risk management has been developed. This new method is based on the radiation detriment optimization measures advocated in the revised (1977) ALARA concept. The methodology includes the determination of available alternatives, and the determination of the variable monetary ceiling on expenditures to reduce the radiological detriment (both occupational and public). The method used to determine the maximum justifiable expenditure for additional reduction of detriment takes into account the economic and social climate, administrative/legal exposure limits, and the actual magnitude of risk. All these factors may vary from country to country. The variable monetary ceiling, sensitive to an actual level of risk, provides a handy measure allowing designers to make a decision whether or not the modification of design is necessary and/or cost effective. This will ensure rationally and consistently that the utilities and their customers (public) get maximum benefit for their safety dollars.

45990 **(EGG-HS—6185) Control of heavy loads at nuclear power plants, Grand Gulf Nuclear Station Units 1 and 2 (Docket Nos. 50-416 and 50-417). Final, Phase I.** Maringas, N. (EG and G Idaho, Inc., Idaho Falls (USA)). Mar 1983. Contract AC07-76ID01570. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016486.

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The Grand Gulf Nuclear Station Units 1 and 2 now totally complies with the guidelines of NUREG-0612 as a result of cooperation between the staffs of NRC, EG and G, TERA Corporation, and the applicant.

45991 **(EGG-M—00884) Limitations of detecting inadequate core cooling with core exit thermocouples.** Adams, J.P.; McCreery, G.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 11p. (CONF-840614—104). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016347.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

USNRC has suggested that the thermocouples (TCs) currently installed at the flow exit of a PWR core could be used to detect a condition of inadequate core cooling (ICC). The use of these TCs has been assumed in the USNRC Regulatory Guide 1.97. PWR vendors have responded to this guideline by proposing ICC instrumentation and procedure packages that include the use of core-exit TCs as a principal means of ICC detection. The core-exit TCs are judged to be able to detect an ICC condition because steam in the core will be superheated by the fuel rods and then flow past the TCs during an accident. The detection of superheat in the fluid stream constitutes the indirect detection of a core uncovery and heatup, or ICC. Data have been analyzed from four experiments conducted in the Loss-of-Fluid Test (LOFT) facility and the results indicate that there are two limitations to the detection of ICC by core exit TCs that should be resolved before reliance can be placed in the measurement. The LOFT TCs are described and these limitations are discussed in this paper.

45992 **(EGG-M—10584) Characterization of solid debris transported in the coolant during the first two severe fuel damage tests.** Vinjamuri, K.; Osetek, D.J.; Hobbins, R.R.; Doyle, T.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1 Jun 1984. Contract AC07-76ID01570. 14p. (CONF-840701—23). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016218.

From Topical meeting on fission product behavior and source term research; Snowbird, UT, USA (15 Jul 1984).

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This paper presents the results of the characterization of solid debris collected from the coolant during the Severe Fuel Damage Scoping Test and the Severe Fuel Damage Test 1-1 conducted in PBF. A variety of analytical techniques was used to characterize the debris samples. Fission product release fractions and particle size distributions were measured, and the probable chemical forms in the debris were identified.

45993 **(EGG-TIO-M—0284) Radionuclide distribution in TMI-2 reactor building basement liquids and solids.** Horan, J.T.; McIsaac, C.V.; Keefer, D.G. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 12p. (CONF-840701—22). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016216.

From Topical meeting on fission product behavior and source term research; Snowbird, UT, USA (15 Jul 1984).

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As a result of the TMI-2 accident, approximately 2.46 x 10^6 L of contaminated water were released to the Reactor Building basement. The principal fission product release pathway from the damaged core was through the reactor coolant system (RCS) to the pressurizer, through the pressure-operated relief valve (PORV) on the pressurizer to the Reactor Coolant Drain Tank (RCDT), and then through the RCDT rupture disk to the Reactor Building basement. Since August 1979, a number of efforts have been made to determine the location, quantity, and composition of fission products released to the Reactor Building basement. These efforts have included sampling of the basement water and solids, the basement sump pump recirculation line, the RCDT, and visual surveys using a closed circuit television (CCTV) system. The analysis of basement samples has provided data on the physical and radioisotopic characteristics of the liquids and solids. This paper describes the sample collection techniques and discusses radiochemical analyses results.

45994 **(EGG-TIO-M—0384) Results of surface activity and radiation field measurements made during surface decontamination experiments conducted at TMI-2.** McIsaac, C.V.; Davis, C.M.; Horan, J.T.; Keefer, D.G. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 16p. (CONF-840701—24). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016217.

From Topical meeting on fission product behavior and source term research; Snowbird, UT, USA (15 Jul 1984).

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The Gross Decontamination Experiment was conducted on various levels and surfaces of the TMI-2 Reactor Building during February and March 1982 and was designed to investigate the effectiveness of various surface decontamination techniques. The polar crane, D-rings, missile shields, refueling canal, fueling bridge, major equipment, floors and some walls were flushed with low pressure water. Water lances were directed manually and applied water at temperatures between ambient and 60°C at a flow rate of about 95 liters per minute. In addition, floor surfaces on the 305-ft elevation and floor surfaces and major equipment on the 347-ft elevation were sprayed with high pressure water (floors in the Reactor Building are designated by their elevations above sea level). The water pressure in this case varied between 13.8 and 41.4 mPa and water temperature was at a maximum 60°C. Certain surfaces were also decontaminated using either strippable coatings or a mechanical scrubbing device.

45995 **(EPRI-NP—3635) Deterministic sensitivity analysis of two-phase flow systems: forward and adjoint methods. Final report.** Cacuci, D.G. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 92p. NTIS, PC A05/MF A01 - EPRI; GPO Dep. File Number DE84016276.

This report presents a self-contained mathematical formalism for deterministic sensitivity analysis of two-phase flow systems, a detailed application to sensitivity analysis of the homogeneous equilibrium model of two-phase flow, and a representative application to sensitivity analysis of a model (simulating pump-trip-type accidents in BWRs) where a transition between single phase and two phase occurs. The rigor and generality of this sensitivity analysis formalism stem from the use of Gateaux (G-) differentials. This report highlights the major aspects of deterministic (forward and adjoint) sensitivity analysis, including derivation of the forward sensitivity equations, derivation of sensitivity expressions in terms of adjoint functions, explicit construction of the adjoint system satisfied by these adjoint functions, determination of the characteristics of this adjoint system, and demonstration that these characteristics are the same as those of the original quasilinear two-phase flow equations. This proves that whenever the original two-phase flow problem is solvable, the adjoint system is also solvable and, in principle, the same numerical methods can be used to solve both the original and adjoint equations.

45996 **(INIS-mf—8889) Measuring methods and transducers for the acquisition of process values in highly transient pressure relief of reactors.** Zirnig, W. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.). Fachbereich Anlagen- und Verfahrenstechnik); Brockmann, E. (Ruhrgas A.G., Dorsten (Germany, F.R.)). (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). 1982. 21p. (In German). (CONF-8206211—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE84780612.

From 20. chemical engineering exhibition-congress; Frankfurt am Main, F.R. Germany (6 Jun 1982).

The statement on hand describes some of the transducers that have successfully been used in pressure relief tests under LWR safety research in pressure and temperature ranges of up to 140 bar and 320°C. The measuring systems in question showed that transducers can be adapted all the easier into extreme testing conditions, the simpler the entire test assembly.

45997 (INIS-mf—9031, pp 327-336) **Cost-benefit, reliability a diagnostics relationships in nuclear power plants.** Cech, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A03/MF A01. File Number TI84780526. (CONF-8112102—Vol.4).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

The quality of nuclear power plants is discussed with regard to reliability, safety and availability. Unsolved problems are given concerning the specification of components of such a plant as reparable and irreparable, giving the basic differences with regard to reliability. Technical diagnostics is used for deciding the operating ability of components and the localization of failures in nuclear power plants.

45998 **(NUREG—0606-Vol.6-No.3) Unresolved safety issues summary. Aqua Book. Volume 6, No. 3.** Butts, J. (comp.). (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). 17 Aug 1984. 101p. NTIS, PC A06/MF A01 - GPO*. File Number TI84901853.

The unresolved safety issues summary is designed to provide the management of the Nuclear Regulatory Commission with a quarterly overview of the progress and plans for completion of generic tasks addressing unresolved safety issues reported to Congress pursuant to Section 210 of the Energy Reorganization Act of 1974 as amended. This summary utilizes data collected from the Office of Nuclear Reactor Regulation, Office of Nuclear Regulatory Research, and the national laboratories and is prepared by the Office of Nuclear Reactor Regulation.

45999 **(NUREG—0675-Suppl.27) Safety Evaluation Report related to the operation of Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Docket Nos. 50-275 and 50-323).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jul 1984. 64p. NTIS, PC A04/MF A01 - GPO* $3.50. File Number TI84901733.

Supplement 27 to the Safety Evaluation Report for Pacific Gas and Electric Company's application for a license to operate Diablo Canyon Nuclear Power Plant, Unit 1 (Docket No. 50-275), has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. This supplement addresses the revisions to the license conditions and to the Technical Specifications as they relate to Amendment 10 to Diablo Canyon, Unit 1 Facility Operating License, DPR-76.

46000 **(NUREG—0831-Suppl.5) Safety Evaluation Report related to the operation of Grand Gulf Nuclear Station, Units 1 and 2 (Docket Nos. 50-416 and 50-417). Supplement No. 5.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Aug 1984. 77p. NTIS, PC A05/MF A01 - GPO* $5.00. File Number TI84901949.

Supplement 5 to the Safety Evaluation Report for Mississippi Power and Light Company, et al., joint application for licenses to operate the Grand Gulf Nuclear Station, Units 1 and 2, located on the east bank of the Mississippi River near Port Gibson in Claiborne County, Mississippi, has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. This supplement reports the status on the resolution of those issues that require further evaluation before authorizing operation of Unit 1 above 5% of rated power.

46001 **(NUREG—0831-Suppl.6) Safety Evaluation Report related to the operation of Grand Gulf Nuclear Station, Units 1 and 2 (Docket Nos. 50-416 and 50-417). Supplement 6.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Aug 1984. 216p. NTIS, PC A10/MF A01 - GPO* $6.50. File Number TI84901829.

Supplement 6 to the Safety Evaluation Report for Mississippi Power and Light Company et al. joint application for licenses to operate the Grand Gulf Nuclear Station, Units 1 and 2, located on the east bank of the Mississippi River near Port Gibson in Claiborne County, Mississippi, has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. This supplement reports the NRC staff's evaluation of open items from previous supplements and Technical Specification changes required before authorizing operation of Unit 1 above 5% of rated power.

46002 **(NUREG—1084) Safety Evaluation Report related to the renewal of the operating license for the research reactor at Michigan State University (Docket No. 50-294).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Aug 1984. 93p. NTIS, PC A05/MF A01 - GPO* $4.75. File Number TI84901852.

This Safety Evaluation Report for the application filed by the Michigan State University (MSU) for a renewal of operating license number R-114 to continue to operate the TRIGA Mark I research reactor has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. The facility is owned and operated by the Michigan State University and is located on the campus of Michigan State University in East Lansing, Ingham County, Michigan. The staff concludes that the TRIGA reactor facility can continue to be operated by MSU without endangering the health and safety of the public.

46003 **(NUREG/CR—1873) Study of two-fluid model and interfacial area.** Ishii, M.; Mishima, K. (Argonne National Lab., IL (USA)). Dec 1980. Contract W-31-109-ENG-38. 59p. (ANL—80-111). NTIS, PC A04/MF A01 - GPO. File Number TI84017617.

The interfacial transfer terms are the weakest link in a two-fluid-model formulation, because of considerable difficulties in terms of experimentation as well as modeling. However, these terms are of supreme importance for a two-fluid model in determining phase interactions between liquid and vapor. In view of these, the interfacial transfer terms have been studied in detail and new constitutive relations have been developed. The interfacial terms are proportional to the interfacial area and driving force; therefore these two effects are modeled separately. In addition, new flow-regime criteria that are appropriate for a two-fluid model are proposed.

46004 **(NUREG/CR—3474) Long-lived activation products in reactor materials.** Evans, J.C.; Lepel, E.L.; Sanders, R.W.; Wilkerson, C.L.; Silker, W.; Thomas, C.W.; Abel, K.H.; Robertson, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 171p. (PNL—4824). NTIS, PC A08/MF A01 - GPO $6.00. File Number TI84017215.

The purpose of this program was to assess the problems posed to reactor decommissioning by long-lived activation products in reactor construction materials. Samples of stainless steel, vessel steel, concrete, and concrete ingredients were analyzed for up to 52 elements in order to develop a data base of activatable major, minor, and trace elements. Large compositional variations were noted for some elements. Cobalt and niobium concentrations in stainless steel, for example, were found to vary by more than an order of magnitude. A thorough evaluation was made of all possible nuclear reactions that could lead to long lived activation products. It was concluded that all major activation products have been satisfactorily accounted for in decommissioning planning studies completed to date. A detailed series of calculations was carried out using average values of the measured compositions of the appropriate materials to predict the levels of activation products expected in reactor internals, vessel walls, and bioshield materials for PWR and BWR geometries. A comparison is made between calculated activation levels and regulatory guidelines for shallow land disposal according to 10 CFR 61. This analysis shows that PWR and BWR shroud material exceeds the Class C limits and is, therefore, generally unsuitable for near-surface disposal. The PWR core barrel material approaches the Class C limits. Most of the remaining massive components qualify as either Class A or B waste with the bioshield clearly Class A, even at the highest point of activation. Selected samples of activated steel and concrete were subjected to a limited radiochemical analysis program as a verification of the computer model. Reasonably good agreement with the calculations was obtained where comparison was possible. In particular, the presence of ^{94}Nb in activated stainless steel at or somewhat above expected levels was confirmed.

46005 **(NUREG/CR—3569) Spectral and dosimetric measurements of photon fields at commercial nuclear sites.** Roberson, P.L.; Endres, G.W.R.; Fox, R.A.; Haggard, D.L.; Holbrook, K.L.; Rathbun, L.A. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 184p. (PNL—4915). NTIS, PC A09/MF A01 - GPO. File Number TI84016300.

Spectral and dosimetric measurements of photon fields were performed at seven commercial nuclear reactor sites (four PWRs and three BWRs). Revisions in 10 CFR 20 that specify exposure-to-dose conversion factors (C/sub x/) much greater than unity for photons between 40 keV and 200 keV could impact personnel monitoring practices. Monitoring at effective depths of 1 cm of tissue and shallower could underestimate doses received from high-energy photon fields (>3 MeV). No locations with large C/sub x/ factors (approximately 1.5 rad/R) were found. The most significant production of low-energy photons was found to be due to photon scattering. The scatter continuum has an effective C factor of approximately 1.2 rad/R. One location was found with a nearly pure scatter spectrum. Other locations contained significant contributions from medium-energy photons due primarily to radioactive decay of cobalt and cesium isotopes. Monitoring requirements at 0.007-cm and 1.0-cm depths in tissue were found to be adequate for estimating dose received in radiation fields containing high-energy photons. Enhanced surface doses attributed to high-energy knock-on electrons were measured in all locations monitored. Personnel monitoring techniques may provide inaccurate results in high-energy fields.

46006 **(NUREG/CR—3589-2) Reactor safety research. Quarterly report, April-June 1983. Volume 26.** (Sandia National Labs., Albuquerque, NM (USA)). Jul 1984. Contract AC04-76DP00789. 168p. (SAND—83-2425-2). NTIS, PC A08/MF A01 - GPO. File Number TI84017046.

This report describes progress in a number of activities dealing with current safety issues relevant to both light water and breeder reactors. The work includes a broad range of experiments to simulate accidental conditions to provide the data base required to understand important accident sequences and to serve as a basis for development and verification of the complex computer simulation models and codes used in accident analysis and licensing reviews. Such a program includes the development of analytical models, verified by experiment, which can be used to predict reactor and safety system performance under a broad variety of abnormal conditions. Current major emphasis is focused on providing information to NRC relevant to its deliberations and decisions dealing with severe LWR accidents and its safety evaluation of the proposed Clinch River Breeder Reactor.

46007 **(NUREG/CR—3689-Vol.4) Materials Science and Technology Division Light-Water-Reactor Safety Research Program. Volume 4. Quarterly progress report, October-December 1983.** (Argonne National Lab., IL (USA)). Aug 1984. Contract W-31-109-ENG-38. 165p. (ANL—83-85-Vol.4). NTIS, PC A08/MF A01 - GPO. File Number TI84017313.

The research and development areas covered are Environmentally Assisted Cracking in Light Water Reactors, Transient Fuel Response and Fission Product Release, Clad Properties for Code Verification, and Long-Term Embrittlement of Cast Duplex Stainless Steels in LWR Systems.

46008 **(NUREG/CR—3787) Effectiveness of Engineered Safety Feature (ESF) systems in retaining fission products: background information.** Mishima, J.; Blahnik, D.E.; Halverson, M.A.; Postma, A.K.; Zaloudek, F.R. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 111p. (PNL—5101). NTIS, PC A06/MF A01 - GPO $5.00. File Number TI84017092.

The Pacific Northwest Laboratory has compiled and reviewed base line data on the effectiveness of Engineered Safety Feature (ESF) systems in the retention of fission products and particulate material resulting from a nuclear reactor accident. This work is part of an NRC project to provide the best estimates of the consequences of severe reactor accidents. The resulting report describes the ESF systems (containment spray, secondary containment filter, containment recirculating filter, pressure suppression pool, ice condenser, and main steam line isolation valve leakage control systems). Also described are the anticipated atmospheres in which the ESFs must operate, the experimental studies of ESF system effectiveness, and the models currently available for assessing the performance of the various ESF systems. The information gaps identified as a result of this review have resulted in recommendations for additional work in the areas of: (1) performance data and models of containment chiller/coolers; (2) continued development and experimental verification of the ice condenser model; (3) continued development of the pressure suppression pool model; and (4) continued investigations of the behavior of filtration devices.

46009 **(NUREG/CR—3821) Evaluation of the crack plane equilibrium model for predicting plastic fracture.** Butler, T.A.; Smith, F.W. (Los Alamos National Lab., NM (USA)). Jul 1984. Contract W-7405-ENG-36. 20p. (LA—10129-MS). NTIS, PC A02/MF A01 - GPO. File Number TI84017105.

A simple model for predicting the initiation of crack growth during plastic fracture is evaluated. The model is based on requiring equilibrium between applied loads and an assumed stress distribution in the uncracked ligament near the crack. The fracture parameters required are the material's ultimate tensile strength and a

process-zone size at the crack tip that is determined from simple fracture tests. The Crack Plane Equilibrium model predicts crack-growth initiation for the crack geometries studied with sufficient accuracy to warrant extending it for investigating other geometries and for predicting stable crack growth and the onset of unstable crack growth.

46010 **(NUREG/CR—3830-Vol.1) Aerosol release and transport program. Volume 1. Semiannual progress report, October 1983-March 1984.** Adams, R.E.; Tobias, M.L. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 77p. (ORNL/TM—9217/V1). NTIS, PC A05/MF A01 - GPO. File Number TI84015504.

Topics discussed include: (1) the experimental program in the Fuel Aerosol Simulant Test (FAST) Facility; (2) NSPP experiments involving mixtures of aerosols of iron oxide and uranium oxide in steam and dry atmospheres; (3) support work for the DEMONA (West Germany) and Marviken (Sweden) projects; (4) analysis of core-melt experiments involving boric oxide volatility; (5) initial operation of the new 250-kW induction generator; (6) comparisons of NAUA results with experiments; and (7) tests and improvements in the UVABUBL-II code.

46011 **(NUREG/CR—3845) Prediction of nonlinear structural response in LMFBR elevated-temperature piping.** Farrar, C. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 24p. (LA—10090-MS). NTIS, PC A02/MF A01 - GPO. File Number TI84017104.

The development of structural analysis capabilities to investigate possible accident initiations caused by structural degradation of liquid metal fast breeder reactor (LMFBR) piping is summarized. The ABAQUS finite element code is used to perform a nonlinear analysis of a bench mark problem proposed by the Pressure Vessel Research Committee. The problem is representative both in geometry and loading of an LMFBR elevated-temperature piping system, and published analytical results are available for comparison. Results show the system to be most sensitive to large, radial, thermal gradients that occur when the system experiences certain thermal transients. Repeated cycles of these transients will lead to thermal ratcheting, causing progressive deformation and strain accumulation in the system. Future work will verify the accuracy of the finite element model and quantify damage accumulated during the lifetime of an LMFBR elevated-temperature piping system.

46012 **(NUREG/CR—3852) Insights into PRA methodologies.** Gallagher, D.; Lofgren, E.; Atefi, B.; Liner, R.; Blond, R.; Amico, P. (Science Applications, Inc., McLean, VA (USA)). Aug 1984. Contract AC05-81OR20837. 125p. (SAI—84/3026). NTIS, PC A06/MF A01 - GPO $5.00. File Number TI84017399.

Probabilistic Risk Assessments (PRAs) for six nuclear power plants were examined to gain insight into how the choice of analytical methods can affect the results of PRAs. The PRA sreflectope considered was limited to internally initiated accidents sequences through core melt. For twenty methodological topic areas, a baseline or minimal methodology was specified. The choice of methods for each topic in the six PRAs was characterized in terms of the incremental level of effort above the baseline. A higher level of effort generally reflects a higher level of detail or a higher degree of sophistication in the analytical approach to a particular topic area. The impact on results was measured in terms of how additional effort beyond the baseline level changed the relative importance and ordering of dominant accident sequences compared to what would have been observed had methods corresponding to the baseline level of effort been employed. This measure of impact is a more useful indicator of how methods affect perceptions of plant vulnerabilities than changes in core melt frequency would be. However, the change in core melt frequency was used as a secondary measure of impact for nine topics where availability of information permitted. Results are presented primarily in the form of effort-impact matrices for each of the twenty topic areas. A suggested effort-impact profile for future PRAs is presented.

46013 **(NUREG/CR—3932) Benchmark description of current regulatory requirements and practices in nuclear safety and reliability assurance.** Halverson, S.L.; Bezella, W.A.; Charak, I.; Mueller, C.J. (Argonne National Lab., IL (USA)). Aug 1984. Contract W-31-109-ENG-38. 119p. (ANL—84-34). NTIS, PC A06/MF A01 - GPO. File Number TI84016161.

The objectives of this work are to evaluate and benchmark the current safety and reliability assurance-related practices employed by the NRC. This effort represents an initial phase of a program whose overall purpose is to develop a reliability program (RP). A review of NRC regulations relevant to reliability assurance was made for a boiling water reactor using two representative safety systems; the reactor protection system, and the residual heat removal system. The primary sources of information were the NRC Standard Review Plan and Title 10 of the Code of Federal Regulations, especially Part 50. In addition, relevant regulatory guides, NRC branch technical positions and industry consensus standard were identified and catalogued for the two reference safety systems over the plant's life cycle. The identified standards and criteria were then organized into a RP element matrix of current regulatory requirements organized by life cycle phase, top level assurance function, and items directly auditable by the NRC. A brief review of the licensing process was also undertaken to indicate the effectiveness of NRC implementation of a RP. The results of this work showed that within the NRC regulations a framework already exists in which to integrate, not add, a reliability assurance program.

46014 **(ORNL—6081) Improved robotic equipment for radiological emergencies.** Chester, C.V. (Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017637.

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A study has been made of the requirements for an improved mobile manipulator for use by the US Department of Energy (DOE) in radiological emergencies. Emergency personnel with experience in past or present (Three Mile Island) radiological emergencies were interviewed to determine the shortcomings of present equipment and features most desired in future equipment. The present technology of mobile manipulators was reviewed. The existing DOE remotely controlled mobile manipulators are single-arm, nonforce-reflecting and have inherent limitations to their mobility and ease of operation. A survey of past radiological emergencies and routine operations at DOE facilities and two commercial power reactors, including TMI, indicates that great improvements in mobility and manipulator dexterity will be required if mobile manipulators are to be more useful in reducing radiation exposure to operating and emergency personnel. In particular, the ability to climb stairs and climb over airlock thresholds is required. Bilateral, force-feedback manipulators would greatly increase the speed, reliability, and safety of manipulator operations. In recent years dramatic advances have been made in manipulator technology with the development of digital control and force feedback. The development of a six-legged, computer-controlled walker by the Odetic Corporation is a quantum improvement in mobility. Unfortunately the Odex walker will likely require another $1 million in development funds before it will be ready for commercial production. The cost of the first-advanced capability, walker-mounted mobile manipulator will likely be between $1 and $2 million dollars but holds the promise of removing the need for men in a variety of hazardous environments. In 1984 NTG Nukleartechnik of West Germany offered a bilateral, force-reflecting master/slave-controlled manipulator mounted on a variable-geometry crawler for only $250,000.

46015 **(SAND—83-2594C) Classification of United States light water reactors by dominant core melt frequency contributors.** Harper, F.T.; Drouin, M.T.; Krantz, E.A. (Sandia National Labs., Albuquerque, NM (USA); Science Applications, Inc., La Jolla, CA (USA); EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC04-76DP00789. 11p. (CONF-840914—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016936.

From International meeting on thermal nuclear reactor safety; Karlsruhe, F.R. Germany (10 Sep 1984).

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In the past ten years a relatively small number of Light Water Reactors (LWRs) in the United States (US) have been the object of intense risk analysis. These plants have been used as surrogates to evaluate generic safety issues at other plants. There are many problems with the surrogate approach to generic nuclear safety research, the most obvious being that nuclear plants in the US are almost always different from one another in ways that affect plant risk. To address this problem, the Accident Sequence Evaluation Program (ASEP) is classifying LWRs in the US by dominant core melt sequence contributors - excluding external events. These contributors are identified through examination of approximately 100 US LWRs. Although the ASEP grouping scheme is complex, it should be considered in generic studies to better understand generic safety issues.

46016 **(SAND—83-2630C) Severe accident reactor risks and the potential for risk reduction.** Benjamin, A.S.; Behr, V.L.; Haskin, F.E.; Kunsman, D.M. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 11p. (CONF-840914—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016765.

From International meeting on thermal nuclear reactor safety; Karlsruhe, F.R. Germany (10 Sep 1984).

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Sandia National Laboratories is performing the Severe Accident Risk Rebaselining and Risk Reduction Program (SARRP) in order to incorporate insights from ongoing programs and task forces toward a rebaselining of reactor risks and of the overall uncertainty. A second objective is to evaluate the benefits and costs of proposed new safety features designed to reduce the frequencies and/or consequences of severe accidents. Results to date indicate that onsite financial risks are generally higher than offsite financial risks, that the uncertainties in the offsite risks are much larger than those in the onsite risks, and that expensive safety options are probably not cost-effective. These results will be a key input to the Nuclear Regulatory Commission's upcoming decision making on severe accidents.

46017 **(SAND—84-0056C) Modeling the economic consequences of LWR accidents.** Burke, R.P.; Aldrich, D.C.; Rasmussen, N.C. (Sandia National Labs., Albuquerque, NM (USA); Massachusetts Inst. of Tech., Cambridge (USA)). 9 Sep 1984. Contract AC04-76DP00789. 11p. (CONF-840914—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016786.

From International meeting on thermal nuclear reactor safety; Karlsruhe, F.R. Germany (10 Sep 1984).

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Models to be used for analyses of economic risks from events which may occur during LWR plant operation are developed in this study. The models include capabilities to estimate both onsite and offsite costs of LWR events ranging from routine plant outages to severe core-melt accidents resulting in large releases of radioactive material to the environment. The models can be used by both the nuclear power industry and regulatory agencies in cost-benefit analyses for decisionmaking purposes. The newly developed economic consequence models are applied in an example to estimate the economic risks from operation of the Surry Unit 2 plant. The analyses indicate that economic risks from US LWR operation, in contrast to public health risks, are dominated by relatively high-frequency forced outage events. Even for severe (e.g., core-melt) accidents, expected offsite costs are less than expected onsite costs for the Surry site. The implications of these conclusions for nuclear power plant operation and regulation are discussed.

46018 **(SAND—84-0320C) Testing and analysis of containment models.** Blejwas, T.E. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 12p. (CONF-840914—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016791.

From International meeting on thermal nuclear reactor safety; Karlsruhe, F.R. Germany (10 Sep 1984).

To better understand the structural and leakage behavior of US containments during severe accidents, Sandia National Laboratories is testing and analyzing scale models of containment structures. The quasi-static pneumatic pressurization of models of steel containments of 1/32 scale has been completed and testing of a 1/8 scale steel model is now beginning (September 1984). By comparing results of analyses (conducted by Sandia and others) with the experimental data, methods for analyzing the structural behavior of containments are being qualified. Leakage data is being obtained during tests of the larger models that have operable equipment hatches. The leakage will be correlated with measured and predicted distortions of the sealing surfaces.

46019 **(SAND—84-0518C) MELPROG model for integrated melt progression analysis.** Kelly, J.E.; Young, M.F.; Tomkins, J.L.; Maudlin, P.J.; Camp, W.J. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 12p. (CONF-840914—8). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016787.

From International meeting on thermal nuclear reactor safety; Karlsruhe, F.R. Germany (10 Sep 1984).

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The in-vessel modules of the integrated LWR melt progression analysis code, MELPROG, are described. These in-vessel modules are being developed along with a reactor coolant system model and a containment response model to provide a detailed, best-estimate analysis tool for severe accident analysis in both BWR and PWR designs. The MELPROG code, which is designed to treat melt progression from accident inception up to and through melt ejection from the reactor vessel, consists of eight explicitly coupled modules: Fluids, Pin-Behavior, Structures, Debris Formation/Behavior, Radiation, Vapor Explosions, Fission Product Release and Transport, and Material Ejection. The first version of the code, which includes the first five modules, has been completed and tested on a simulation of an S1D accident. Results of that simulation are presented.

46020 **(SAND—84-0522C) Results of the in-pile degraded core coolability experiments: DCC-1 and DDC-2.** Boldt, K.R.; Kuenstler, P.A. Jr.; Schmidt, T.R. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 11p. (CONF-840914—12). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017004.

From International meeting on thermal nuclear reactor safety; Karlsruhe, F.R. Germany (10 Sep 1984).

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The results of DCC-1 and DCC-2, the first Degraded Core Coolability experiments in the USNRC's Severe Fuel Damage Program, are presented. The experiments evaluated the coolability of a fission-heated UO_2 debris bed in a water bath with pressure variable from 1 to 170 atmospheres. The 0.5-meter deep bed consisted of small-sized particulate with an average diameter of 0.4 mm for DCC-1 and large-sized particulate with an average diameter of 1.8 mm for DCC-2. DCC-1 evaluated deep bed behavior in the laminar coolability regime while DDC-2 examined coolability in the transition and turbulent flow regimes. The main results presented are the dryout heat flux dependence on pressure and the rate and method of quench of dry debris.

46021 **(SAND—84-1569C) Human reliability data bank: feasibility study.** Comer, K.; Miller, D.P.; Donovan, M. (General Physics Corp., Columbia, MD (USA); Sandia National Labs., Albuquerque, NM (USA); General Physics Corp., Atlanta, GA (USA)). 1984. Contract AC04-76DP00789. 9p. (CONF-841099—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84015215.

From Human Factors Society annual meeting; San Antonio, TX, USA (22 Oct 1984).

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The US Nuclear Regulatory Commission and Sandia National Laboratories have been developing a plan for a human reliability data bank since August 1981. This research is in response to the data needs of the nuclear power industry's probabilistic risk assessment community. The three phases of the program are to: (A) develop the data bank concept, (B) develop an implementation plan and conduct a feasibility study, and (C) assist a sponsor in implementing the data bank. The program is now in Phase B. This paper describes the methods used in the feasibility study. Decisions to be

made in the future regarding full-scale implementation will be based, in part, on the outcome of this study. 3 references, 2 figures.

46022 **(UCID—20086) Circuit breaker operation and potential failure modes during an earthquake: a preliminary investigation.** Lambert, H.E. (Lawrence Livermore National Lab., CA (USA)). 9 Apr 1984. Contract W-7405-ENG-48. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017603.

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This study addresses the effect of a strong-motion earthquake on circuit breaker operation. It focuses on the loss of offsite power (LOSP) transient caused by a strong-motion earthquake at the Zion Nuclear Power Plant. This report also describes the operator action necessary to prevent core melt if the above circuit breaker failure modes occur simultaneously on three 4.16 KV buses. Numerous circuit breakers important to plant safety, such as circuit breakers to diesel generators and engineered safety systems, (ESS), must open and/or close during this transient while strong motion is occurring. Nearly 500 electrical drawings were examined to address the effects of earthquakes on circuit breaker operation. Due to the complexity of the problem, this study is not intended to be definitive but serves as a focusing tool for further work. 5 references, 9 figures, 3 tables.

46023 **(UCID—20122-Vol.1) SSI response of a typical shear wall structure. Volume 1.** Johnson, J.J.; Schewe, E.C.; Maslenikov, O.R. (Lawrence Livermore National Lab., CA (USA)). Apr 1984. Contract W-7405-ENG-48. 141p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84017503.

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The Simplified Methods project of the US NRC-funded Seismic Safety Margins Research Program (SSMRP) has as its goal the development of a methodology to perform routine seismic probabilistic risk assessments of commercial nuclear power plants. The study reported here develops calibration factors to relate best estimate response to design values accounting for approximations and simplifications in SSI analysis procedures. Nineteen cases were analyzed and in-structure response compared. The structure of interest was a typical shear wall structure. 6 references, 44 figures, 22 tables.

46024 **(UCID—20122-Vol.2) SSI response of a typical shear wall structure. Appendix B. In-structure response spectra comparisons. Volume 2.** Johnson, J.J.; Schewe, E.C.; Maslenikov, O.R. (Lawrence Livermore National Lab., CA (USA)). Apr 1984. Contract W-7405-ENG-48. 791p. NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE84017441.

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The objectives of this study were two-fold: (1) develop building response calibration factors, i.e., factors which relate best estimate or median level response to responses calculated by selected design procedures. Soil-structure interaction was the phenomenon of interest because significant simplifications are frequently introduced in its treatment; and (2) the second objective can be viewed in the context of a question: what effect does placing an identical structure on different sites and with different foundation conditions have on structure response. The structure selected for this study is a part of the Zion AFT complex. Only the auxiliary, fuel-handling, and diesel generator buildings were studied. This structure is a connected group of shear-wall buildings constructed of reinforced concrete, typical of nuclear power plant structures. The bases of comparison for this study were structure responses: peak in-structure accelerations (27 components), and peak wall forces and moments (111 components). In-structure response spectra were also considered. This appendix contains in-structure response spectra comparisons in detail.

46025 **(UCID—20163) Impact of assumptions concerning containment failure on the risk from nuclear power plants.** Lappa, D.A. (Lawrence Livermore National Lab., CA (USA)). 10 Sep 1984. Contract W-7405-ENG-48. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017160.

We describe the containment failure mode and release category assumptions used in the seismic risk study of the Zion nuclear power plant, which was performed by the Seismic Safety Margins Research Program (SSMRP). We then, for the dominant accident sequences, reassign containment failure modes and release categories based upon current thinking. We recalculate the seismic risk from the Zion facility using the new assumptions. Lastly, we discuss the impact of the new assumptions on the results and the relevance of the assumptions to value/impact analyses. 5 references, 5 tables.

46026 **(UCRL—90410) Seismic risk assessment as applied to the Zion Nuclear Generating Station.** Wells, J. (Lawrence Livermore National Lab., CA (USA)). Aug 1984. Contract W-7405-ENG-48. 12p. (CONF-840914—10). NTIS, PC A02/MF A01; GPO Dep. File Number DE84017099.

From International meeting on thermal nuclear reactor safety; Karlsruhe, F.R. Germany (10 Sep 1984).

To assist the US Nuclear Regulatory Commission (NRC) in its licensing and evaluation role, the NRC funded the Seismic Safety Margins Research Program (SSMRP) at Lawrence Livermore National Laboratory (LLNL) with the goal of developing tools and data bases to evaluate the risk of earthquake caused radioactive release from a commercial nuclear power plant. This paper describes the SSMRP risk assessment methodology and the results generated by applying this methodology to the Zion Nuclear Generating Station. In addition to describing the failure probabilities and risk values, the effects of assumptions about plant configuration, plant operation, and dependence will be given.

46027 **(UCRL—91369) Multivent effects in a large scale boiling water reactor pressure suppression system.** McCauley, E.W.; Aust, E.; Schwan, H. (Lawrence Livermore National Lab., CA (USA); GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 6 Jul 1984. Contract W-7405-ENG-48. 17p. (CONF-840914—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016228.

From International meeting on thermal nuclear reactor safety; Karlsruhe, F.R. Germany (10 Sep 1984).

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The steam-driven GKSS pressure suppression test facility, which contains 3 full scale vent pipes, has been used for 5 years to investigate the postulated loss-of-coolant accident in a Mark II and Type 69 boiling water reactor. Using the results from several of these tests, wetwell boundary load data (peak pressures and spectral power) during the chugging stage, have been evaluated for sparse pool response (one and two vents in the three vent pool) and for full pool response (one, two, or three vent operation in pools of constant wetwell pool area per vent). The sparse pool results indicate the pool-system, chug event boundary loads are strongly dependent on wetwell pool area per vent, with the load increasing with decreasing area. The full pool results show a substantial increase in the pool-system, chug event boundary loads upon a change from single cell to double cell operation; only minor change occurs in going from double to triple cell operation.

46028 **Low-order LOFT primary model prediction of L9-3 ATWS.** Tylee, J.L. (EG & G Idaho Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **46**: 837-838(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

46029 **TWIST: A transient two-dimensional intrasubassembly thermal hydraulics model for LMFBRs.** Khatib-Rahbar, M.; Cazzoli, E.G. (Brookhaven National Laboratory, Upton, NY 11973). *Transactions of the American Nuclear Society;* **46**: 818-820(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

46030 **MINET validation study using EBR-11 transient data.** Van Tuyle, G.J. (Brookhaven National Laboratory, Upton, NY 11973). *Transactions of the American Nuclear Society;* **46**: 812-813(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

46031 **Adjoint sensitivity analysis of a thermal-hydraulic system undergoing phase change due to boiling transition.** Cacuci, D.G.; Kaizerman, S.; Tomerian, N.; Wacholder, E. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **46**: 870-871(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

46032 **A simple interphase drag model for two-fluid numerical modeling of two-phase flow systems.** Chow, H.; Ransom, V.H. (EG & G Idaho Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **46**: 853-855(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

46033 **Identification of dose reduction techniques for BWR and PWR repetitive high-dose jobs.** Dionne, B.J.; Baum, J.W. (Brookhaven National Laboratory, Upton, NY 11973). *Transactions of the American Nuclear Society;* **46**: 649-650(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

25 ENERGY STORAGE

2501 Magnetic

46034 **(N—84-12636) Storage of energy in magnetic field of superconductive coils.** Lipinska, N.; Lipinski, W. (Air Force Systems Command, Wright-Patterson AFB, OH (USA)). Jul 1983. 8p. (AD-A—131898). NTIS, PC A02/MF A01.

The storage of energy in the magnetic field of superconductive coils is discussed. The selection of superconducting materials is discussed, as is operational stability.

2502 Compressed Gas

46035 **(DOE/ET/29015—T1) Compressed air energy storage - salt caverns project. Monthly progress report No. 12, September 1978.** Wilson, L.A. (Middle South Services, Inc., New Orleans, LA (USA)). Sep 1978. Contract AC02-77ET29015. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017610.

Progress is reported in the areas of: administration, compressed air power system analysis, compressed air energy storage facility criteria definition (specifically machinery configuration), site selection and costing, and preliminary environmental and safety assessment. (LEW)

2506 Thermal

REFER ALSO TO CITATION(S) 25060045780, 46115

46036 **(CEA-CONF—7181) Feasibility of a heat storage in captive aquifers.** Despois, J.Y.L.; Conseil, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); Societe Nationale Elf-Aquitaine (France)). Nov 1983. 8p. (CONF-831137—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE84751843.

From International seminar on energy saving in buildings; Hague, Netherlands (14 Nov 1983).

The French Commissariat a l'Energie Atomique (CEA) and the National Society Elf-Aquitaine (SNEA) have undertaken feasibility studies of an underground heat storage in deep aquifers, allowing initial temperatures of 180-200°C. It allows a good efficiency of restitution to distant heating networks (60-70°C) from garbage incineration plants or nuclear power plants which may, during summer, dispose of surplus heat. To demonstrate the feasibility of this type of storage, the CEA and the SNEA have choosed a site in Paris suburb. An exploration well has been drilled near a garbage incinerator, until a sandy aquifer situated at a depth of 500 meters. The hydro-geological and geochemical data gathered have allowed to do a digital simulation of the behaviour of a whole system source-storage-network. The construction of this system is going to start. In case of success, the inter-seasonal transfer of 15 GWh/year, besides the current delivery, will permit the heating of about 4000 apartments of the city of Plaisir.

46037 **(CONF-840804—41) Possibilities of conjugating binary solutions for thermal energy storage.** Grodzka, P.G. (Lockheed Missiles and Space Co., Inc., Huntsville, AL (USA). Research and Engineering Center). 1984. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016704.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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A concept for thermal energy storage (TES) has recently emerged that depends on the heats of mixing of a pair of different liquids at a critical solution temperature. Liquid pairs that mix or unmix at a critical solution temperature (CST) are called conjugating binary (CB) systems. The possibilities of the concept for chill and heat storage for residential and commercial purposes are reviewed and the results of material searches for the different applications reported. An economic analysis of the concept for commercial chill storage shows that the concept compares favorably with ice storage systems.

46038 **(FRNC-TH—1652) Study of an interseasonal heat storage in the ground by drilling and equidistributed tubular exchangers.** Leroy, G. (Paris-6 Univ., 75 (France)). Dec 1982. 80p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE84751844.

A description of the storage system is given. An assessment of the system effectiveness through schematic models is presented. Then, a description of the experimental installation is given, and the preliminary measurements of conductivity are presented after the description of the probes used for the experiment.

46039 **(FRNC-TH—1655) Contribution to the study of the thermal stratification in heat accumulators in relaxation phase.** Najam, M. (Poitiers Univ., 86 (France)). Dec 1982. 89p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE84751846.

The different phenomena involved in the relaxation process of a heat stratification accumulator are described. A description of an experimental storage cycle which allows to visualize the changes in the temperature field, is given. The experimental results are analysed. A theoretical study based on a one-dimensional analysis of the problem is then developed. The effect of dimensional parameters and dimension characteristics of thermal relaxation on the evolution of stratification is analysed. Finally, theoretical and experimental results are compared.

2509 Batteries

46040 **(ANL/OEPM—84-2) Research, development, and demonstration of lead-acid batteries for electric vehicle propulsion. Annual report, 1983.** (Johnson Controls, Inc., Milwaukee, WI (USA). Globe Battery Div.). Jun 1984. Contract W-31-109-ENG-38. 115p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84017442.

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Research is reported in the areas of active material utilization and active material integrity; design and fabrication of components, advanced cells, and modules; cell testing; and battery thermal management and electrolyte circulation subsystems. (LEW)

46041 **(ANL/OEPM—84-3) Annual report for 1983 on research, development, and demonstration of nickel-iron batteries for electric vehicle propulsion.** (Eagle-Picher Industries, Inc., Joplin, MO (USA)). Aug 1984. Contract W-31-109-ENG-38. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017430.

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The significant developments during 1983 indicate the program goals for the nickel-iron battery can be achieved. Plaque development has progressed to the point where entirely production feasible nickel sinter can be produced in thickness up to 4.0 mm. This plaque is being drawn in one continuous process for slurry application, drying, and sintering. Batteries designed for power capability possess the attributes for ehv applications. Small lightweight designs would provide 100% DOD capacity without sacrifice of cycle life while delivering the power density required for acceleration. The operating temperature range of the nickel iron battery can be extended to the region of -20 and even -30°C with the addition of sulfide to the electrolyte. This treatment produces no apparent deleterious effects on normal temperature performance. It appears that the battery can be winterized if and when it is required. The real life cycle capability of the battery is emerging from the life cycle testing. The provisions to avoid the soft-short due to iron sludge in the region of 800 cycles are being shown to be effective. Modules are presently at cycle 1000 with tests continuing. The vent-watering system has been demonstrated to be adequate for the near term. Repeated watering does not upset the electrolyte concentration. The air dilution vent system has been shown to have a large safety margin in protection against external ignition. The nickel-iron battery has now demonstrated itself to be a practical system.

46042 **(NP—4770378) Basic studies on a positive iron-hydroxide-electrode in the alkaline accumulator.** Koehler-Priese, G. (Goettingen Univ. (Germany, F.R.). Interfakultatives Lehrgebiet Chemie). 3 Jul 1981. 106p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84770378.

The feasibility of a rechargeable positive electrode is demonstrated for the alkaline accumulator on the basis of iron-hydroxide. Pure iron hydroxides have been prepared with a specific charging capacities up to 30 g/Ah at discharge currents of 0.2 A and an active mass of 3 g. The main characteristics of the substances with higher specific charging capacities are a good electric strength of the discharge plateau (discharge hardness) and the high stability under cyclic operation (actually more than 400 cycles without any capacity reduction). Besides amorphous hydrogides only α-FeOOH (geothite) has been found in the samples.

46043 **(NP—4770409) Studies on positive hydrated manganese oxide electrodes for alkali batteries.** Bauer, J. (Goettingen Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 28 Oct 1982. 103p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84770409.

Pure and doped manganese hydrated oxides of various oxidation state of the metal were prepared and studied for their suitability as positive electrode for alkali batteries. Measurement of discharge characteristics of test electrodes was carried out using charge cycle apparatus with computer controlled data recording systems. It could be shown that pure hydrated manganese oxide could be cyclised with small currents up to 20 mA. Maximum capacities of 24 mAh/g could be achieved by salting out at constant pH-value in the region of the isoelectric point of the solid. The preparation of manganese(II)-aluminium-double hydroxides resulted in a double hydroxide with 26.5 mol% proportion of aluminium and a maximum capacity of 121 mAh/g. Hydroxides of this group with levels of aluminium $<$ 10 mol% may, at 35 mAh/g, possess smaller capacities but give up to 60 discharge cycles. Magnesium and calcium coated substituted compounds could be prepared by co-precipitation of manganese(II) nitrates with the appropriate earth alkali metal compounds.

46044 **Storage batteries for energy conservation.** Meredith, R.E. (Oregon State Univ., Corvallis). pp 131-174 of Fourth annual energy seminar. Erie, PA; Gannon University (1982). (CONF-8203126—).

From 4. annual energy seminar; Erie, PA, USA (23 Mar 1982).

An overview is presented of the DOE Battery Program. This program is aimed at the development of safe, reliable, and inexpensive storage batteries for application in three programs: the electric vehicle, utility load leveling and solar photovoltaics. 540 million barrels of oil per year can be saved with these three programs. The cost, service life, and cyclability of utility load-leveling and solar photovoltaics are presented. 43 figures.

29 ENERGY PLANNING AND POLICY

46045 **(NP—4770376) Uruguay - energy situation 1982.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Sep 1983. 30p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84770376.

A short survey is given on Uruguay's energy situation marked by a number of data stated. A few comments on national and international energy policy are followed by a description of the development taken by individual energy carries and electricity generation. In addition, some important figures as to foreign trade or balance of payment, resp., are supplied.

46046 **(NP—4770383) Spain - energy situation 1982.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1984. 44p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84770383.

The energy situation of Spain is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and on the balance of payments.

46047 **(NP—4770384) Denmark - energy situation 1982.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1984. 27p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84770384.

The energy situation of Denmark is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and on the balance of payments.

46048 **(NP—4770385) Cyprus - energy situation 1982.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1984. 9p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE84770385.

The energy situation of Cyprus is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and on the balance of payments.

46049 **(NP—4770386) Venezuela - energy situation 1982.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1984. 14p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE84770386.

The energy situation of Venezuela is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and on the balance of payments.

46050 **(NP—4770390) Turkey - energy situation 1982.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1984. 29p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84770390.

The energy situation of Turkey is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the

trends observed for the various energy sources. Figures are given on external trade and the balance of payments.

46051 **(NP—4770391) Argentina - energy situation 1982/83.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1984. 22p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE84770391.

The energy situation of Argentina is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payments.

46052 **(NP—4770392) Australia - energy situation 1982.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Dec 1983. 50p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84770392.

The energy situation of Australia is reviewed in detail on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends oberved for the various energy sources. Figures are given on external trade and the balance of payments.

46053 **(NP—4770393) Great Britain - energy situation 1982.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1984. 44p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84770393.

The energy situation of Great Britain is reviewed in detail on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payments.

46054 **(NP—4770407) Spain - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Dec 1982. 44p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84770407.

The energy situation of Spain is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payments.

46055 **(NP—4770408) Ethiopia - energy situation 1982/83.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Feb 1984. 15p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE84770408.

The energy situation of Ethiopia is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and on the balance of payments.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 29010045306, 45448, 46058, 46088

46056 **(DOE/EIA—0354(82/2)) State Energy Overview 1982.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Aug 1984. 453p. NTIS, PC A20/MF A01 - GPO; GPO Dep. File Number DE84017043.

Data are presented for the 50 states and the District of Columbia. Included are the quantities of energy produced and consumed, estimates of fuel reserves, the value of nonrenewable fuels produced by type, energy expenditures, and consumer prices. Also provided for each state are selected demographic and energy-related data that have been ranked and expressed as a percent of the national total. This overview provides a ready reference and a quick access to selected state energy information and state rankings for various socioeconomic and energy items. Methodology is detailed; a glossary is provided.

46057 **(NP—4770363) Energy balance Bavaria 1982.** (Bayerisches Staatsministerium fuer Wirtschaft und Verkehr, Muenchen (Germany, F.R.)). Dec 1983. 104p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84770363.

The energy balance 1982 for Bavaria is introduced and explained. This is followed by explanations of development and structure of primary and end energy consumption in Bavaria until 1982. Details on the situation and the development of the energy sources electricity, gas, mineral oil and oil are given. The situation of district heat in Bavaria is dealt with. Annex: Summary of the prognosis results of the German Institute for Economic Research, Berlin, entitled: Future development of energy consumption in Bavaria until the year 2000. According to the nature and task of an energy balance, the publication consist mainly of figures.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 29020045400, 45446, 45447, 45480, 45569, 45570, 46044, 46079, 46087, 46089, 46102

46058 **(NP—4901749) Mineral revenues: the 1983 report on receipts from Federal and Indian leases with summary data from 1920 to 1983.** (Minerals Management Service, Washington, DC (USA). Royalty Management Program). 1984. 76p. GPO*. File Number TI84901749.

Tables and figures abound for: mineral revenue management in 1983; offshore federal mineral revenues; onshore federal mineral revenues; Indian mineral revenues; distribution of federal and Indian mineral revenues; plus appended lease management data. (PSB)

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 29030045710, 46066, 46067, 46071, 46073, 46586, 46587, 46588, 46599

46059 **(DOE/NBM—4016409) Columbia River Basin Fish and Wildlife Program: Issue Paper 1, funding.** (Northwest Power Planning Council, Portland, OR (USA)). 1984. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016409.

This paper examines the following issues related to the Bonneville Power Administration's (BPA's) obligation to provide funding of fish and wildlife program measures: (1) should BPA be required to fund measures at federal projects; (2) should BPA be required to fund measures at non-federal or even non-hydroelectric projects; and (3) should BPA be required to fund measures which consist of tribal or fish and wildlife agency activities. (ACR)

46060 **(GAO/RCED—84-91) EPA's efforts to clean up three hazardous waste sites.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 7 Jun 1984. 23p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901898.

This report focuses on the Environmental Protection Agency's (EPA's) efforts to clean up three hazardous waste sites in New Jersey, Ohio, and Rhode Island. Cleanup actions taken at the three sites GAO reviewed ranged from containing on-site waste to moving the waste to another site. However, these sites still have contamination problems, and studies are underway to determine how best to handle them. EPA is required to select the most cost-effective method to clean up hazardous waste sites. Until EPA completes studies necessary to define long-term cleanup solutions for each of these three sites and the cost of accomplishing those solutions, the most cost-effective method for these sites cannot be determined.

46061 **(GAO/RCED—84-100) EPA's efforts to identify and control harmful chemicals in use.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 13 Jun 1984. 71p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901874.

Under the Toxic Substances Control Act of 1976, the Environmental Protection Agency (EPA) is responsible for identifying, assessing, and controlling unreasonable risks to health or the environment from the manufacture, processing, distribution, use, or disposal of new and existing chemicals - those currently in commerce. This report focuses on EPA's efforts to review and control existing chemicals. To date, EPA has acted to control four existing chemicals and has conducted priority reviews of two other chemicals. In addition, EPA has identified 22 other chemicals that it has determined need testing for certain health and environmental effects. However, EPA has not yet finalized the rules requiring chemical firms to conduct the needed testing of these chemicals. Since 1982, EPA has taken several actions which strengthened its existing chemicals program. Also, the President's fiscal year 1985 budget includes proposed increases for the program. GAO believes that additional emphasis is needed to ensure that: (1) testing begins for the 22 chemicals that EPA has already determined require testing; and (2) priority review is given to chemicals that present or will present a significant risk of serious or widespread harm from cancer, birth defects, or gene mutations. This report includes a recommendation to EPA and matters for the Congress' consideration in addressing these areas.

46062 **(GAO/RCED—84-146) State experiences with taxes on generators or disposers of hazardous waste.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 4 May 1984. 60p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901519.

To raise revenue for hazardous waste cleanup efforts and to provide greater economic incentives for more desirable hazardous waste management practices, the Congress is considering various taxes on hazardous waste generation, transportation, treatment, storage, and disposal. This report discusses the experiences New York, New Hampshire, and California have had with taxes similar to those now proposed at the federal level. GAO found that the three states: have not collected the revenues they anticipated, have not determined if the tax achieved its objective of encouraging more desirable waste management practices, and were concerned that a similar federal tax may reduce state tax revenue or increase the incentive to illegally dispose of hazardous waste. In addition, GAO believes that in order to implement similar federal taxes, more data are needed on the types and quantities of waste generated and the disposal methods used. These data are necessary to realistically estimate revenue, measure changes in disposal practices, and assure compliance with the tax. 2 tables.

46063 **(GAO/RCED—84-152) EPA's preliminary estimates of future hazardous waste cleanup costs are uncertain.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 7 May 1984. 18p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901486.

This report evaluates the Environmental Protection Agency's Superfund Task Force preliminary study on the future resources needed to clean up the nation's worst uncontrolled hazardous waste sites. EPA's study estimates that the federal government could spend between $8.4 billion and $16 billion to clean up these sites. These estimates are based on uncertainties concerning the number of hazardous waste sites, the construction costs needed for the cleanup, and the extent that cleanup can be accomplished without using federal funds. Because of these uncertainties, GAO found that the range could be from $5.3 billion to $26 billion, which suggests a need for better data before a more useful estimate can be developed. As mandated in section 301 of the Superfund Act, EPA is currently conducting a more detailed study on cleanup costs.

46064 **(LA—9445-PNTX-L) Supplementary documentation for an Environmental-Impact Statement regarding the Pantex Plant: description of facilities and estimation of resource requirements.** Schnurr, N.M. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 21p. NTIS, PC A02/MF A01. File Number DE84008071.

This report documents work performed in support of the preparation of an Environmental Impact Statement (EIS) regarding the Department of Energy's Pantex Plant near Amarillo, Texas. The specific areas discussed include a detailed description of each alternative covered by the EIS and the cost, labor, and construction material requirements for each alternative. The rationale used in the selection of alternatives is discussed. The procedures used to estimate costs, labor, and construction material requirements are outlined, and detailed breakdowns of those quantities are included.

2904 Natural Resources

REFER ALSO TO CITATION(S) 29040046059

46065 **(DOE/BP—288) Comments to the Northwest Power Planning Council on the Draft Fish and Wildlife Program.** (USDOE Bonneville Power Administration, Portland, OR). Oct 1982. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017141.

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The comments of the Bonneville Power Administration on the Draft Fish and Wildlife Program are divided into two parts. Part 1 addresses Bonneville concerns regarding program funding, a subject that overlaps all sections of the draft program. Part 2 addresses specific concerns section by section, and includes an elaboration and application of concerns raised in Part 1. The comments focus on recommendations for specific language changes and concisely state the grounds for these recommendations.

46066 **(DOE/BP—289) Comments to the Northwest Power Planning Council on the Fish and Wildlife Program amendments.** (USDOE Bonneville Power Administration, Portland, OR). Aug 1984. 99p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84016998.

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This document contains the written comments of the Bonneville Power Administration (BPA) on proposed amendments to the Columbia River Basin Fish and Wildlife Program as contained in the Northwest Power Planning Council's Draft Amendment Document dated June 6, 1984.

46067 **(DOE/NBM—4016402) Columbia River Basin Fish and Wildlife Program: Issue Paper 11A/amendment scheduling.** (Northwest Power Planning Council, Portland, OR (USA)). 1984. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016402.

Chapter 11 of the Northwest Power Planning Council's power plan calls for a second round of proceedings to amend the Council's Fish and Wildlife Program beginning December 15, 1984. The paper discusses, for a variety of reasons, alternative scheduling of the proceedings. (ACR)

46068 **(DOE/NBM—4016403) Columbia River Basin Fish and Wildlife Program: Issue Paper 10, wildlife.** (Northwest Power Planning Council, Portland, OR (USA)). 1984. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016403.

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Measures 1004 (b), (c) and (d) of the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program are designed to follow a phased approach from planning to the formulation of specific recommendations detailing wildlife protection, mitigation and enhancement activities. The issue discussed is whether the Council should refine the planning and implementation approach taken in the wildlife section of the program. (ACR)

46069 (DOE/NBM—4016404) Columbia River Basin Fish and Wildlife Program: Issue Paper 9A, resident fish goals. (Northwest Power Planning Council, Portland, OR (USA)). 1984. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016404.

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The question of whether the Northwest Power Planning Council should approve the funding of studies which will lead to the adoption of goals for resident fish is discussed. (ACR)

46070 (DOE/NBM—4016405) Columbia River Basin Fish and Wildlife Program: Issue Paper 12/technical corrections. (Northwest Power Planning Council, Portland, OR (USA)). 1984. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016405.

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Technical corrections to the Columbia River Basin Fish and Wildlife Program are presented along with explanations for the corrections. (ACR)

46071 (DOE/NBM—4016406) Columbia River Basin Fish and Wildlife Program: Issue Paper 2, ocean survival/ harvest controls. (Northwest Power Planning Council, Portland, OR (USA)). 1984. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016406.

This paper examines the following issues related to the Columbia River Basin Fish and Wildlife Program's measures intended to counteract the pressure management agencies receive to relax regulations and allow increased catch: (1) have the harvest management agencies implemented controls that are adequate to protect restoration of depressed salmon stocks in the Columbia Basin; (2) is restricting the construction of the Yakima hatchery and the John Day acclimation ponds an effective means of pressuring harvest management agencies to implement controls; and (3) would restrictions on other types of facilities or measures be more effective. (ACR)

46072 (DOE/NBM—4016407) Columbia River Basin Fish and Wildlife Program: Issue Paper 4, demonstration research projects. (Northwest Power Planning Council, Portland, OR (USA)). 1984. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016407.

This paper examines the question of whether the Bonneville Power Administration should fund demonstration research projects to develop and test fish bypass systems and screens. (ACR)

46073 (DOE/NBM—4016408) Columbia River Basin Fish and Wildlife Program: Issue Paper 8, protected areas. (Northwest Power Planning Council, Portland, OR (USA)). 1984. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016408.

Measure 1204(c) of the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program requires the Bonneville Power Administration to fund a study of alternative means for designating areas to be protected from future hydroelectric development. This paper discusses current approaches to the study and alternative recommendations. (ACR)

46074 (DOE/NBM—4016410) Columbia River Basin Fish and Wildlife Program: Issue Paper 9B, resident fish. (Northwest Power Planning Council, Portland, OR (USA)). 1984. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016410.

The issue discussed is whether the Northwest Power Planning Council should add, delete, or modify measures in the Columbia River Basin Fish and Wildlife Program on resident fish hatcheries, habitat improvement, water purchases, enhancement opportunities and project operations. (ACR)

46075 (DOE/NBM—4016411) Columbia River Basin Fish and Wildlife Program: Issue Paper 11, program scheduling. (Northwest Power Planning Council, Portland, OR (USA)). 1984. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016411.

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The Columbia River Basin Fiash and Wildlife Program contains more than 220 action items. The program contains completion dates for some measures, but not all. The program gives little direction on the appropriate sequence for implementing other measures. The issues discussed include: (1) should the Council adopt a three-year action plan and five-year objectives for program implementation; (2) if so, what three-year actions and five-year objectives should be included; and (3) should the Council change completion dates in the Fish and Wildlife Program. (ACR)

46076 (DOE/NBM—4016413) Columbia River Basin Fish and Wildlife Program: Issue Paper 6B, offsite enhancement. (Northwest Power Planning Council, Portland, OR (USA)). 1984. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016413.

This paper examines the question of whether the Northwest Power Planning Council should adopt 47 new measures to provide for additional offsite enhancement for anadromous fish losses attributable to hydroelectric facilities. (ACR)

46077 (DOE/NBM—4016414) Columbia River Basin Fish and Wildlife Program: Issue Paper 6, subbasin planning. (Northwest Power Planning Council, Portland, OR (USA)). 1984. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016414.

The concept of subbasin planning, a criterion for evaluating and recommending habitat improvement and passage restoration measures, has been proposed. This paper examines the issue of whether the Northwest Power Planning Council should adopt the concept of subbasin planning in its Columbia River Basin Fish and Wildlife Program. (ACR)

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 29050045484, 45739, 45788, 46080, 46083, 46105, 47053, 47150, 47221

46078 (NP—4770405, pp 1-18) Energy research in the Federal Republic of Germany. Diehl, H. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

In this introduction to the seminar held on the state of "Geotechnology and Deposits", the base lines of research promotion policy of the government of the Federal Republic of Germany are expounded in full detail. A number of current projects are used for exemplification.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 29060045445, 45509, 45528

46079 (CONF-840813—13) Regional comparison of nuclear and fossil electric power generation costs. Bowers, H.I. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016696.

From Design, construction and operation of nuclear power plants conference; Portland, OR, USA (5 Aug 1984).

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Nuclear's main disadvantages are its high capital investment cost and uncertainty in schedule compared with alternatives. Nuclear plant costs continue to rise whereas coal plant investment costs are staying relative steady. Based on average experience, nuclear capital investment costs are nearly double those of coal-fired generation plants. The capital investment cost disadvantage of nuclear is balanced by its fuel cost advantages. New base load nuclear power plants were projected to be competitive with coal-fired plants in most regions of the country. Nuclear power costs wre projected to be significantly less (10% or more) than coal-fired power costs in the South Atlantic region. Coal-fired plants were projected to have a significant economic advantage over nuclear

plants in the Central and North Central regions. In the remaining seven regions, the levelized cost of power from either option was projected to be within 10%. Uncertainties in future costs of materials, services, and financing affect the relative economics of the nuclear and coal options significantly. 10 figures.

2910 Conservation

REFER ALSO TO CITATION(S) 29100046044, 46092, 46093, 46100, 46120

46080 **(DOE/CE—0016/3) Annual report to the President and the Congress on the State Energy Conservation Program for calendar year 1983.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Energy Management and Extension). Aug 1984. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016388.

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This report contains a summary of the activities resulting from the State Energy Conservation Program during the period from December 1982 through December 1983. Included are discussions of estimates on energy conservation achieved and the degree of state participation. 3 tables. (DMC)

46081 **(DOE/R8/07227—T1) Energy policy and regulations report: Price City, Utah. Final report.** (Millard Consultants, Salt Lake City, UT (USA)). 30 Sep 1982. Contract FG48-81R807227;FG48-81R807238. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84015412.

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The US Department of Energy and the Utah Energy Office have participated in the review of energy policies and regulations in certain Utah municipalities and in particular have provided funds for Price City to analyze its own existing policies and regulations and make technical recommendations for study and adoption in the City Master Plan and Land Development Code. This report is submitted as a basis for preparing the necessary documents for amending the City Master Plan and Land Development Code. Two major goals can thus be achieved: (1) provide a procedure for allowing modifications of and variances for existing buildings to take advantage of solar energy design and components, and (2) provide a procedure and standards for guiding new development design to incorporate energy conservation elements. The object is not to inconvenience residents and developers with more regulations, but to allow and encourage them to maximize the utilization of renewable energy sources, conserve energy from non-renewable sources, and accrue the resultant savings and comfort.

46082 (EPRI-P—3404-SR, pp 413-471) **Energy Management and Utilization Division.** Jan 1984. Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920398.

In 1984-1988 Research and Development Program Plan.

The research and development activities of the EPRI Energy Management and Utilization Division are discussed. These activities include fuel cells and hydrogen, energy storage and hydroelectric generation, residential and commercial, industrial, and electric transportation.

46083 **(MTR—7693) Energy Extension Service: relationship to other ERDA programs.** (Mitre Corp., McLean, VA (USA). METREK Div.). Sep 1977. Contract AC01-77ET20554. 75p. (EES—0035-1). NTIS, PC A04/MF A01; GPO Dep. File Number DE84014770.

The Energy Research and Development Administration (ERDA) has established the joint Federal-State Energy Extension Service (EES) in 10 pilot states, selected competitively. Both the pilot and nationwide EES programs are designed to be state planned and operated with financial and technical support and program guidance and evaluation from ERDA. The primary objective of the EES is to encourage the adoption by small energy consumers of techniques and technologies that save energy and/or use renewable energy resources. The EES program focuses on the provision of direct assistance on a local and personalized basis to small energy consumers. Techniques and technologies may include some developed by ERDA technology programs and may also include many developed by other Federal, state and private-sector efforts available on the open market. A second objective of EES is the provision to ERDA of consumer feedback on their requirements for new technology, on barriers to the use of new technology and on the degree of acceptance of new technology by energy consumers. This report deals with the following issues: (1) identification of ERDA programs and functions with which EES should be coordinated, including mutual assistance of EES and other ERDA programs; (2) analysis of specific features of the potential coordination of EES and other ERDA programs, and how each organization might help the other; and (3) identification of significant issues regarding coordination for subsequent follow-up.

46084 **(NP—4901294) Ohio Energy Extension Service Plan.** (Ohio Dept. of Energy, Columbus (USA)). Jul 1983. 62p. NTIS, PC A04/MF A01. File Number DE84901294.

The Department of Energy is assisting the State of Ohio in funding a program to deliver energy conservation information to smaller energy users within the state and to encourage adoption of energy conserving measures and practice. This report describes the program and presents a revised budget reflecting the additional federal funds. Discussion is presented under the headings: consumer information and education; energy outreach program; small business; and administration. (DMC)

46085 **(P—400-84-001) Regulations for the California conservation tax credit.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 1984. 22p. California Energy Commission, 1516 9th St., Sacramento, CA 95814. File Number TI84901562.

This document establishes the minimum standards for energy conservation measures which are eligible for California state tax credits. For certain conservation measures, a Residential Conservation Service (RCS) audit must be performed before the measure is installed. Measures requiring this preinstallation audit are listed. (DMC)

2920 Supply, Demand, And Forecasting

46086 **(ANL/CNSV-TM—140) Implementing local energy programs: potential solutions to management problems.** Kron, N.F. Jr.; Meshenberg, M.J. (Argonne National Lab., IL (USA)). Sep 1983. Contract W-31-109-ENG-38. 52p. NTIS, PC A04/MF A01; GPO Dep. File Number DE84017565.

Potential solutions to local community energy program implementation problems are compared and adapted for the example communities of Richmond, Indiana; Ann Arbor, Michigan; and Portland, Maine. Four major areas considered are: problems arising from leadership and sponsorship of program; content of program; funding and timing of activities; and objectives of the program. (PSB)

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 29300045450, 45452, 45453, 45583, 46061, 46081, 46085, 46086, 46590, 47053, 47218, 47219

46087 **Fiscal year 1985 Department of Energy authorization. Volume I. Hearing before the Subcommittee on Energy Research and Production and the Subcommittee on Energy Development and Applications, US House of Representatives, Ninety-Eighth Congress, Second Session, March 13, 1984.** Washington, DC; Government Printing Office (1984). 160p.

Volume I of the hearing record covers the March 13, 1984 testimony of Martha Hesse, Assistant DOE Secretary for Management and Administration, on the fiscal year 1985 budget request for DOE administration. Ms. Hesse discussed specific budget justifications, including funding for the Technical Information Services, in-house energy management, and policy initiatives, such as the realignment of some functions within the department, the introduction of an integrated accouting and personnel and payroll systems, and other efforts to reduce overhead costs. She reported a three

percent drop in staffing level. Following a prepared statement by Ms. Hesse and introductory remarks by committee members, the bulk of the hearing record contains responses to committee questions.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 29400045306, 45400, 45404, 45404, 45445, 45446, 45447, 45448, 45450, 45452, 45453, 45456, 45458, 45459, 45460, 45480, 45484, 46079

46088 (DOE/EIA—0456) Linkage methodology of the Intermediate Future Forecasting System/Gas Analysis Modeling System interface for the Annual Energy Outlook, 1983. (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Sep 1984. 51p. NTIS, PC A04/MF A01; 1 - GPO; GPO Dep. File Number DE84017153.

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The Energy Information Administration (EIA) developed the Intermediate Future Forecasting System (IFFS) and the Gas Analysis Modeling System (GAMS) as independent projects during the 1981 to 1983 time period. Both modeling systems were designed to be partial equilibrium representations of the energy markets, with, however, quite striking differences in scopes and methodologies. Despite the differences between the two systems, their results overlap in an extremely sensitive and visible area - the pricing, supply, and consumption of natural gas. In an effort to produce consistent forecasts, the two models were linked forming one modeling system referred to as IFFS/GAMS. This report describes the process by which IFFS and GAMS were integrated to produce a single energy forecast for the Annual Energy Outlook, 1983 (AEO). A general description of both models is presented with an emphasis on the areas where the models interact with one another. Finally, a more specific description of the interactions between the models is provided. 21 references, 7 figures.

46089 (GAO/RCED—84-135) Natural gas in Philadelphia: sources, uses, and prices. (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 23 May 1984. 37p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760. File Number TI84901894.

Natural gas prices increased substantially both at the national level and in Philadelphia during the past 8 years. To provide information on the natural gas situation in Philadelphia from 1975 to 1983, GAO focused on the municipally owned and regulated distribution company, the Philadelphia Gas Works. GAO obtained information on: average revenue and expense of the Gas Works' two major pipeline company suppliers; average revenue and expense of the Gas Works itself; prices paid by the Gas Works' retail customers; and assistance to help the Gas Works' residential customers pay their bills and conserve energy.

46090 (NP—4770399) Society of the Petroleum Industry of Austria - annual report 1982. (Fachverband der Erdoelindustrie Oesterreichs, Vienna (Austria)). 1984. 29p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84770399.

The continuing recession in most of the industrial countries, a significant intention of the consumers to save money, and the substitution of mineral oil by other energy sources have reduced the demand for petroleum and petroleum products worldwide. Also in Austria - as seen from statistical data - the downward trend which has been existing since 1980 in the mineral oil industry has been continuing. A reduction in consumption of nearly all product spheres, a diminishing petroleum and natural gas production, a reduction in raw petroleum refining connected with an increased lawcapacity operation of the refineries, a reduction of the raw petroleum and natural gas imports, an increased import pressure concerning the finished products which had negative effects on the domestic production, a regressing employment volume, and increasing losses in the processing and sales section characterize the situation of the petroleum industry in 1982.

2960 Electric Power

REFER ALSO TO CITATION(S) 29600045710, 45923

46091 (DOE/EIA—0226(84/06)) Electric Power Monthly, June 1984. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Sep 1984. 45p. NTIS, PC A03/MF A01; 1 - GPO; GPO Dep. File Number DE84017484.

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This report includes comprehensive information about the electric utility industry in the US during May, 1984. Data on net generation by electric utilities including fossil, hydro, and nuclear power plants, consumption and stockpiles of coal, fuel oils and natural gas, receipts and cost data for May, 1984 for plants of 50-MW or larger, and sales and retail prices of electricity are presented. 26 tables. (DMC)

46092 (DOE/RC/11849—T1-Vol.1) Incentive regulation in the electric utility industry. Volume I. Final report. Goins, D.; Fisher, M.; Smiley, R.; Hass, J.; Ehrenberg, R. (Resource Consulting Group, Inc., Cambridge, MA (USA)). Sep 1983. Contract AC39-82RC11849. 274p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE84016854.

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This report describes the results of conducting a comprehensive analysis of the issues involved in formulating an incentive regulation program and to develop and evaluate an incentive regulation program to be considered for implementation by FERC. In conducting this study, the analysis was structured with the primary objective of designing an incentive regulation program that would encourage the provision of electrical service to customers at the lowest possible price, consistent with a satisfactory level of service quality. To facilitate structuring such a program, we identified and analyzed a set of fundamental issues that must be considered in designing and implementing an incentive regulation program. Three major incentive programs were recommended: (1) a rate contol incentive program; (2) a construction cost control incentive program; and (3) an automatic rate adjustment mechanism. 83 references, 21 figures.

46093 (DOE/RC/11849—T1-Vol.2) Incentive regulation in the electric utility industry. Volume II. Final report. Goins, D.; Fisher, M.; Smiley, R.; Hass, J.; Ehrenberg, R. (Resource Consulting Group, Inc., Cambridge, MA (USA)). Sep 1983. Contract AC39-82RC11849. 232p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE84016853.

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On October 15, 1982, Resource Consulting Group, Inc. (RCG), submitted a draft report to the Federal Energy Regulatory Commission (FERC) titled, Incentive Regulation in the Electric Utility Industry. The FERC distributed the draft report to more than 60 individuals and organizations who were requested to review and comment on the various proposals and recommendations outlined in the report. In response to the FERC's request, 18 organizations submitted formal review comments. This report contains reviewers comments on each of the three programs recommended. The three major incentive programs are: (1) Rate Control Incentive program (RCIP); (2) Construction Cost Control Incentive Program (CCIP); and (3) Automatic Rate Adjustment Mechanism (ARAM).

46094 (EPRI-EA—3587) Annual review of demand and conservation research: 1983 proceedings. (Battelle Columbus Labs., OH (USA)). Jun 1984. 452p. (CONF-8305212—; CONF-8307130—). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920503.

From EPRI seminar on annual review of demand and conservation research; Arlington, VA, USA (17 May 1983).

On May 17-20, 1983, in Arlington, Virginia, and on July 12-15, 1983, in Denver, Colorado, the Electric Power Research Institute, Inc. (EPRI) sponsored seminars titled Annual Review of Demand and Conservation Research. Demand and conservation research within the context of the seminars included all utility projects, studies, and programs that either directly or indirectly are

intended to modify customer usage patterns principally in the direction of reducing system peak load and shifting consumption from peak to off-peak periods. The purpose of the seminars was to promote an active exchange of information among technical analysts and researchers on recent advances in analytical techniques related to demand and conservation research. A secondary purpose was to identify new areas of research that need to be addressed by EPRI. The seminars featured formal presentations on topics such as load forecasting and analysis, rate design, residential time-of-use response, end-use modeling, weather normalization, and load data transferability. In addition, both seminars featured several small-group afternoon sessions for more in-depth discussions.

46095 **(NP—4770372) History of the power industry in Wuerttemberg. Vol. 1.** Leiner, W. (Energie-Versorgung Schwaben A.G., Stuttgart (Germany, F.R.)). 1982. 355p. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE84770372.

This attempts to give a comprehensive history of the development of the early power plants in Wuerttemberg. The fundamental development of electrical engineering are also dealt with. After this development had produced serviceable systems for lighting systems and a public electricity supply economic aspects came into the foreground more (after 1881). Political aspects were emphasized as well when the first public power stations were built. This book covers the period in which the early power stations developed in their structure. Their further development and the beginning of a large-size industry is described in the next book.

46096 **(NP—4770397) German Association for Collective Power Supply - annual report 1982.** (Deutsche Verbundgesellschaft e.V., Heidelberg (Germany, F.R.)). Jul 1983. 25p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE84770397.

Activities, tasks, and organisation of the association in 1982 are reported on. The goal of the activities is to support the expansion of collective working within the German power supply, to improve the cooperation between the German collective supply enterprises and those in the other Western-European countries as well as the cooperation between the German collective supply enterprises and the other branches of the energy industry and the industry.

46097 **Multilevel software: The lowest common denominator.** Jordan, L. (NUS Corporation, 910 Clopper Road, Gaithersburg, MD 20878). *Transactions of the American Nuclear Society;* **46**: 667-669(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

46098 **Consideration of management prudence in a rate case.** Manzi, J.E. (Kellogg Corp., 5601 S. Broadway, Suite 400, Littleton, CO 80121). *Transactions of the American Nuclear Society;* **46**: 598-599(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

46099 **Simulating the spiral of impossibility in the electric utility industry.** Ford, A.; Youngblood, A. (Los Alamos National Laboratory, Los Alamos, NM). *Energy Policy;* **11**: No. 1, 19-38(Mar 1983).

This article examines the 'spiral of impossibility' for different types of investor-owned electric utility companies in the USA. The spiral begins with an increase in electricity price that discourages demand growth. The utility must spread its fixed costs over fewer kilowatt-hours of sales, which, in turn, leads to still higher rates. Computer simulation techniques are used to quantify whether the spiral would pose serious planning problems for utility companies, and the effect of policies that might mitigate the spiral's effects are tested. The conclusion is that the spiral poses substantial planning problems for utility companies building long lead-time power plants, serving customers with high price elasticity of demand and quick response time, but those relying on oil or natural gas are less vulnerable.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 29800045445, 46056, 46094

46100 **(NP—4901298) Annual energy status report, 1981. Ohio energy flow chart.** (Ohio Dept. of Energy, Columbus (USA)). Jan 1982. 5p. NTIS, PC A04/MF A01. File Number DE84901298.

There will be no foreseeable shortage of conventional fuels in Ohio during the coming decade. There is a discussion of various projections on a national, as well as a state-wide, basis for energy demand through the year 1990. Fuel prices will continue to escalate. Perhaps not at the rate experienced during the 1970's, but increased fuel prices will occur. This will result in a demand-side constraint, either through active (insulation) or passive (thermostat setback) measures. We have seen that the conservation ethic in Ohio has had a significant effect on consumption. Ohioans reduced their consumption by 313 trillion Btu's between 1979 and 1980. A recent audit by US DOE credits ODOE programs with a net savings of at least 66 trillion Btu's, with additional probable savings of 54 trillion Btu's. A conservative estimate of Ohio energy prices of $3.00 per million Btu's thus indicates that the Department efforts saved Ohio consumers between $200 and $330 million during 1980. These savings are attributed to the State Energy Conservation Plan (SECP). The remaining energy savings accrued from a combination of the recession which had an effect on industrial and individual energy consumption, plus cost-avoidance by the consumer in their active and passive conservation efforts.

46101 **(WAOENG—84-31) Washington State Energy Use Profile, 1960 to 1983.** (Washington State Energy Office, Olympia (USA); Washington State Univ., Pullman (USA). Office of Applied Energy Studies). Jun 1984. 244p. Washington State Energy Office, 400 East Union, Olympia, WA 98504. File Number TI84901917.

The report is organized into four main sections. The first section is an overview of demographic and economic factors, energy use, energy resources, and prices. The second section provides greater detail on the uses, supplies, and prices of the principal energy resources used in the state. The third section of the report focuses on electricity and describes uses, supplies, and prices for this intermediate energy form. The fourth section disaggregates energy consumption by users and provides additional detail on use in the residential, commercial, industrial, agricultural, and transportation sectors.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 29900045702, 45714, 45739, 45789, 46078

46102 (CONF-8203178—, pp 62-63) **Economy of biogas-plants.** Schuetz, P. Jul 1982. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number TI84770366.

From 10. Salzburg economic inquiry; Salzburg, Austria (4 Mar 1982).

Regarding the biomass potential of Austria the author defines for meeting economic requirements the limiting investing value per livestock unit for a biomass conversion plant. Full development and economy might not yet always coincide.

46103 **(DOE/BP—285) Renewable resource development. Executive summaries of the 1981-82 Bonneville Power financial assistance grants to local governments.** (Allen (Eliot) and Associates, Inc., Salem, OR (USA)). Dec 1983. Contract AC79-79BP13222. 38p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017143.

This booklet contains executive summaries of selected community energy planning projects which were carried out by local governments in the Pacific Northwest with financial assistance from the Bonneville Power Administration (BPA). This program has funded planning efforts which lead to electrical conservation and renewable resource development, and has encouraged local government participation in developing solutions to the region's electric energy needs. The program goals included establishment of

positive relationships between local governments and utilities; development and adoption of plans and ordinances that lead to electrical conservation; and testing of community energy management programs.

46104 **(DOE/CH/10122—26) Field research tasks and technical services. Final report.** (ESG, Inc., Atlanta, GA (USA)). Apr 1984. Contract AC02-82CH10122. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84009473.

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Task areas reportd on include: Residential Building Energy Systems; Domestic Solar Hot Water; Industrial/Commercial Renewable Energy Systems; Industry Reviews and Technology Transfer; and Biomass Field Projects. These tasks represent programs initiated by the Southern Solar Energy Center. In addition, the report details efforts relating to technical services provided in support of the Appropriate Technology Small Grants Program. A listing of all publications issued during the term of the contract is provided.

46105 **(DOE/OR/21390—3) Great Lakes Regional Biomass Energy Program. Quarterly report, March 1, 1984-May 31, 1984.** (Council of Great Lakes Governors, Inc., Madison, WI (USA)). 1984. Contract FG05-83OR21390. 120p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84016326.

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Highlights of progress accomplished during the period from March 1, 1984 through May 31, 1984 are discussed. A literature review of biomass fuel drying techniques was completed and is included in the report. Summaries of the status of programs in the State Grants Program are presented (Illinois, Indiana, Iowa, Wisconsin, Michigan, Ohio). Summaries of the status of the subcontractors' programs are also presented. During this quarter two subcontracts were signed. The first was with the US Forest Service - North Central Experiment Station for economic analysis work pertaining to biomass fuel drying, while the second was with the National Wood Energy Association for the production of the quarterly newsletter Biologue. The planning process for the regional program was initiated this quarter. A survey of the program Technical Advisory Committee was undertaken to identify priority biomass issues. The results of this survey were published and a plan for the regional development of biomass energy was presented at the May 30-31, 1984 joint meeting of the Steering Council and Technical Advisory Committee. The meeting concluded with general recommendations on overall program direction and specific recommendations for second year subcontract projects.

46106 **(DOE/OR/21400—T42) Alternate fuels information requirements review.** Cantor, S. (Oak Ridge National Lab., TN (USA)). 25 Aug 1983. Contract AC05-84OR21400. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84016559.

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The objective of this program is to develop options for collection of data on alternative fuels to fulfill information required by the Federal Government, by the States and by the public. Five energy sources are considered: solar, wind biomass, geothermal, and small-scale hydropower. The information needs checklist includes: importance ratings; geographic aggregation (is the information needed nationwide); reporting period (is the information needed annually, semiannually, etc.); timeliness; and accuracy. The tasks are to determine why and which information is needed; to identify respondent populations; to classify priorities; to compare collected information with prioritized listings; and to formulate options for collection of information and the cost estimate for each option. (DMC)

46107 (NP—4770405, pp 19-38) **Possible utilizations of geothermal energy in the Federal Republic of Germany.** Haenel, R. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

The possible range of utilizing geothermal energy depends considerably on geothermal energy stocks which are to be registered in terms of resources and reserves till 1984. Utilization of heat pumps - as practiced already - has to be viewed as an immediately realizable means for heating small-size residential units. A new trend can be seen in the utilization of so-called geothermal probes. Economical utilization of thermal water for heating or as process heat for medium-sized residential and entreprise units is being examined by means of medium-termed heat installations. Feeding geothermal heat to existing heating systems appears to be advantageous as is the concept of utilizing heat in base load, employing heat pumps with increased heat requirement and of connecting additionally conventional heating systems for covering peak load. If applied in a decentralized way, thermal-water utilization can be expected to contribute to energy supply. Profitable exploitation of subterranean thermal heat at greater depths by means of the hot-dry-rock technology can only be clarified within a long-term study. A large-scale national project is indispensable for this purpose.

46108 **(NP—4901792) Gasohol development plan. Volume II.** (Ohio Dept. of Energy, Columbus (USA)). 30 Sep 1981. 332p. Department of Development, PO Box 1001, Columbus, OH 43216. File Number TI84901792.

The objective of this study is to develop a plan to implement ethanol production plants in the Appalachian area. This plan includes potential markets for farm and forestry products to be utilized in ethanol production. It reflects the impact on the area with the development of new production facilities along with the effect of establishing production and transportation options for feedstock. This plan gives an indication of the direct and indirect employment opportunities created as a result of the potential alcohol industry. The indirect jobs would be those involved with the production of the feedstocks, transportation, construction, supply of plant requirements of products and services, and the fringe employment resulting from sales of the plant product and by-product. This development plan will be utilized to determine the best Appalachian area for construction of a joint venture alcohol plant(s). 65 references, numerous figures and tables.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

46109 **(ANL/MHD—84-1) MHD Heat and Seed Recovery Technology Project. Annual progress report, October 1982-September 1983.** (Argonne National Lab., IL (USA)). Jul 1984. Contract W-31-109-ENG-38. 74p. NTIS, PC A04/MF A01; GPO Dep. File Number DE84017501.

The MHD Heat and Seed Recovery (HSR) Technology Project at Argonne National Laboratory is obtaining information for the design and operation of the steam plant downstream from the MHD channel-diffuser. The project goal is to supply the engineering data required in the design of components for prototype and demonstration MHD facilities. The work is being done in close cooperation with the national Heat Recovery-Seed Recovery Program supported by the MHD Office of the US Department of Energy. The other major contractors are Mississippi State University, the University of Tennessee Space Institute, and Babcock & Wilcox Co. The primary effort of the HSR Technology Project at Argonne comprises experimental investigations of critical problem areas, such as (1) corrosion of metal alloys; (2) NO/sub x/ behavior in the radiant boiler and secondary combustor; (3) radiant boiler design to meet the multiple requirements of steam generation, NO/sub x/ decomposition, and seed-slag separation; (4) effects of solid or liquid seed deposits on heat transfer and gas flow in the steam and air heaters; (5) formation, growth, and deposition of seed-slag particles; and (6) character of the combustion gas effluents. The experiments are performed primarily in a 2-MW test facility, the Fossil Energy Users Laboratory (FEUL). 39 references.

46110 **(PNL—4001-7) Development of materials for open-cycle MHD. Quarterly report for the period ending March 1984.** Marchant, D.D.; Bates, J.L. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76RL01830. 22p. NTIS, PC A02/MF A01. File Number DE84017293.

Pacific Northwest Laboratory (PNL) is conducting a study of channel components for open-cycle, coal-fired magnetohydrodynamic (MHD) generators. Specifically, electrodes and insulators are being developed. The electrical conductivity has been measured on several compositions based on indium oxide-tin oxide (In_2O_3-SnO_2). These compositions have been studied as additives to refractory ceramic oxides to increase the low-temperature electrical conductivity. Indium oxide appears to be the main constituent required for high conductivity. The electrical conductivity of In_2O_3-SnO_2 compositions increases with increasing In_2O_3 concentration and reaches a maximum with compositions containing about 95 mo% In_2O_3. These high In_2O_3-containing compositions behave like degenerate semiconductors; the electrical conductivity decreases with increasing temperature. Three major crystallographic phases were identified for each composition, and were tested for their relative electrical conductivity and corrosion resistance to determine which phase would be most suitable for use as an additive to refractory ceramic oxides.

3005 Fuel Cells

46111 (DOE/NASA—2674-78/2) Evaluation of the ECAS open cycle MHD power plant design. Seikel, G.R.; Staiger, P.J.; Pian, C.C.P. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Nov 1978. Contract AI01-77ET10769. 26p. (NASA-TM—79012). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017134.

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The Energy Conversion Alternatives Study (ECAS) MHD/steam power plant is described. The NASA critical evaluation of the design is summarized. Performance of the MHD plant is compared to that of the other type ECAS plant designs on the basis of efficiency and the 30-year levelized cost of electricity. Techniques to improve the plant design and the potential performance of lower technology plants requiring shorter development time and lower development cost are then discussed. 18 references.

46112 (N—84-13671) Analysis of regenerative fuel cells. Final report. Gross, S. (Boeing Co., Seattle, WA (USA)). Nov 1982. 148p. (NASA-CR—171783). NTIS, PC A07/MF A01.

The concept of a rechargeable fuel cell (RFC) system is considered. A newer type of rechargeable battery, the nickel hydrogen (Ni-H2) battery, is also evaluated. A review was made of past studies which showed large variations in weight, cost, and efficiency. Hydrogen-bromine and hydrogen-chlorine regenerable fuel cells were studied, and were found to have a potential for higher energy storage efficiency then the hydrogen-oxygen system. A reduction of up to 15 percent in solar array size may be possible as a result. These systems are not yet developed, but further study of them is recommended.

3008 Miscellaneous Converters

REFER ALSO TO CITATION(S) 30080046143

46113 (EGG-M—24183) Thermomagnetic generator. Kirol, L.D.; Mills, J.I. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 9p. (CONF-840804—44). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017018.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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Thermomagnetic generators convert heat to electricity directly, without a mechanical interface. Numerical analyses of regenerative thermomagnetic generators have been performed for three materials. Power density and efficiency higher than previously reported in the literature appear achievable. Practical machines may be possible, but further study is required. Some possible configurations are discussed in this paper. Areas for future investigation include identification of optimum materials and verification of heat transfer correlations. Capital cost for a thermomagnetic generator is estimated as comparable to the cost for commercially available low-temperature organic Rankine cycle generators. 15 references.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 32000046101

46114 (CONF-8203178—) Alternative energy sources. (Amt der Salzburger Landesregierung (Austria). Landespressebuero). Jul 1982. 111p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84770366.

From 10. Salzburg economic inquiry; Salzburg, Austria (4 Mar 1982).

On this meeting it had been reported about the applicability and feasibility of techniques using renewable energy sources like solar energy, biomass particular wood fuels, geothermal energy and wind and techniques how to derive fuels from wastes e.g. pyrolysis, gasification and also to use them economically e.g. by dual purpose plants. Another subject are heat pumps. Further topics and aims are the reduction of energy import and the pollution abatement. The feasibility and supply studies refer above all to the Land Salzburg of the republic of Austria; some refer more to the city of Salzburg, like geothermal exploration in the urban area, waste processing and cogeneration. Peculiar attention is paid to the energetic utilization of products and wastes from agriculture and forestry in general and in Austria.

3201 Buildings

REFER ALSO TO CITATION(S) 32010046082, 46139

46115 (BNL—51763) Sulfuric acid chemical heat pump program, March-November 1982. Final report. (Rocket Research Co., Redmond, WA (USA)). Mar 1984. Contract AC02-76CH00016. 249p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE84017436.

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The verification test unit (VTU) designed, built and demonstrated during the previous contract, has been tested extensively. System performance tests using both a single simulated waste heat source and two simulated heat sources of differing temperatures were completed. System thermal COP's ranged from 0.03 to 0.4, depending on test conditions. Steady temperature amplification was repeatedly achieved. An extended duration test with a total operation time in excess of 100 hours was completed. Near the end of the program, the chemical heat pump technology covering requirements, performance, and testing was transferred to the private sector at a one day seminar.

46116 (CONF-8203178—, pp 78-81) **Heat pumps.** Edler, A.; Halozan, H. Jul 1982. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number TI84770366.

From 10. Salzburg economic inquiry; Salzburg, Austria (4 Mar 1982).

The use of heat pumps in Austria can be helpful to reduce fuel import. Some applications to residential buildings are presented in general and by government sponsored examples: one solar assisted heat pump with heat recovery from waste water in Weiz and one gas driven heat pump, using ground water.

46117 (DOE/BP—286) Residential conservation: executive summaries of the 1981-82 Bonneville Power financial assistance grants to local governments. (Allen (Eliot) and Associates, Inc., Salem, OR (USA)). Dec 1983. Contract AC79-79BP13222. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017158.

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This booklet contains executive summaries of selected community energy planning projects which were carried out by local governments in the Pacific Northwest with financial assistance from the Bonneville Power Administration (BPA). The projects described include: the cities of Bothell, Issaquah, Kirtland, and Redmond; Deschutes County; and Spokane County.

46118 **(DOE/CS/30531—T1) Rigid interior thermal window shutter: Phase II and Phase III. Final report.** Mitchell, R.A. (Mitchell (Robert) Solar Systems Design, Inc., Selkirk, NY (USA)). 1984. Contract FC02-80CS30531. 218p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE84015629.

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This final report on the development market evaluation and testing of an adequate movable interior thermal shutter includes information on the following: project overview, predicting the performance of thermal shutters; evolution of design; mechanical testing; flammability; instructions; field test; final specifications; optimum frame length; market analysis; magazine coverage; D-I-Y analysis; production plan; economics on installations; and future plans.

46119 **(DOE/CS/62143—T1) Study of State Energy Conservation Program: 1980 energy savings indicators.** (Price Waterhouse Co., Washington, DC (USA)). 1 Apr 1981. Contract AC01-80CS62143. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84016907.

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This project was designed to provide: (1) a review of the amount of energy savings reported by the states attributable to SECP activities for the calendar year 1980; and (2) a more reasonable national estimate of such savings and their dollar value in 1980. The scope of the project did not include an audit or validation of energy savings reported by states. Instead it was based on analysis of state data on the type and amount of services. The general approach involved: reviewing evaluation methodologies for individual SECP program measures as reported in 1980 energy savings reports submitted by states; for as many measures as possible, identifying valid and/or exemplary evaluation approaches that permit calculation of energy savings attributable to the program measure rather than to price or other factors; using these evaluation approaches, developing a ratio or index of Btu's saved per unit of service provided (e.g., audit performed, audit workbook distributed) for these measures; applying this index to units of service data provided by other states, thereby deriving a total savings estimate for individual program measures; and cumulating savings estimates by program measure to a national total.

46120 **(DOE/CS/69105—3) Hiring and working with a contractor.** (Minnesota Dept. of Energy and Economic Development, St. Paul (USA). Energy Div.). 1984. Contract FG02-80CS69105. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017576.

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This brochure discusses choosing a contractor, obtaining bids, and writing a contract. Sample subcontractor's notice, lien waiver, contract, and cancellation right are included. (MHR)

46121 **(EGG-M—24283) Rotary magnetic heat pump.** Kirol, L.D.; Mills, J.I. (Idaho National Engineering Lab., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 9p. (CONF-840804—47). NTIS, PC A02/MF A01; GPO Dep. File Number DE84017017.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

Magnetic heat pumps use the magneto-caloric effect to produce entropy changes necessary for heat pumping. A rotary magnetic heat pump has been analyzed and computer models have been developed. The contribution of viscous heat to the regenerator heat balance has been found to significantly restrict performance. The contribution of viscous heating is at least as important as the temperature differences required for regenerator heat transfer. Multiple magnet coils on a single rotor reduce the viscous work per field change cycle and result in greatly improved performance. Operation at 80% of Carnot efficiency with a heat pumping rate of 10 kW per kilogram of magnetic material is predicted.

46122 **(EPRI-EM—3627) Proceedings: Illumination Roundtable III. Lighting research and education for the eighties.** (Policy Research Associates, Inc., Sterling, VA (USA)). Jul 1984. 159p. (CONF-8311196—). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920529.

From 3. illumination roundtabel workshop on lighting research and education for the eighties; Keystone, CO, USA (13 Nov 1983).

The workshop - organized around seven panels with representation from users, researchers, designers, and facility planners - addressed the lighting needs of educational facilities, offices, industrial facilities and agricultural production, retail merchandising, transportation, sports facilities, and health care facilities. The individual workshop panels developed research tasks that address the areas of photobiology, vision, system design and integration, esthetics and lighting, energy/load management, education/technology transfer, and technology development. Each panel assigned a budget and schedule to the tasks, along with urgency, stage of completion, and the nature of the research to be done.

46123 **(LBL—16086) Energy efficiency of California buildings: technical potential and progress.** Harris, J.P. (Lawrence Berkeley Lab., CA (USA)). May 1983. Contract AC03-76SF00098. 26p. (CONF-8305126—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016059.

From Franco-Californian symposium on the management of energy in residential and commercial sectors; Sophia Antipolis, France (16 May 1983).

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Estimates of the technical potential for improved energy efficiency in US buildings range up to 50% of current or projected consumption; this is comparable to estimated potential in French buildings. Several conservation varying estimates of savings, but generally less than 50%. Targets for achievable conservation in California, used in forecasting future energy demand and planning conservation programs, are even lower. Still, they represent potential savings of hundreds of millions of dollars in fuel costs and utility capital investments. By comparing conservation potentials and savings actually achieved we can identify areas needing more effort. Even among new buildings and appliances that meet California's strict standards, there is a range of efficiencies on the market. This suggests that further savings are possible from nonregulatory approaches (labeling, incentives) and more emphasis in research and product development. The data show large variations both in energy savings (percent and absolute) and in costs per unit of energy saved. The reasons for this variation are not yet well understood. Also, predicted savings often differ from actual savings, especially for individual buildings. This points to a need for improved models, better quality data, and more effective feedback to building designers, energy managers, and policy-makers on conservation results in actual buildings. 25 references, 10 figures, 2 tables.

46124 **(LBL—17590) Humidity in attics: sources and control methods.** Cleary, P. (Lawrence Berkeley Lab., CA (USA)). Jul 1984. Contract AC03-76SF00098. 15p. (CONF-840819—8). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016878.

From Doing better: setting an agenda for the second decade; Santa Cruz, CA, USA (14 Aug 1984).

Results are presented which show that the attic is in a constant state of flux, absorbing and releasing moisture. A mathematical model for predicting the moisture content of attic wood members is presented. The model is used to predict hour-by-hour attic air humidity ratio, and seasonal wood moisture content. Results are compared with measured data. The application of the model to the re-calculation of attic ventilation standards is discussed, both with respect to condensation and wood rot.

46125 **(LBL—17889) Energy efficiency choice in the purchase of residential appliances.** Ruderman, H.; Levine, M.D.; McMahon, J.E. (Lawrence Berkeley Lab., CA (USA)). Jul 1984. Contract AC03-76SF00098. 13p. (CONF-840819—9). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016885.

From Doing better: setting an agenda for the second decade; Santa Cruz, CA, USA (14 Aug 1984).

This paper provides a quantitative analysis of the behavior of the market for the purchase of energy efficiency in residential appliances and heating and cooling equipment. We examine the historical efficiency choices over the period 1972 to 1980 for eight consumer products: gas central space heaters, oil central space heaters,

room air conditioners, central air conditioners, electric water heaters, gas water heaters, refrigerators, and freezers. We characterize the behavior of the market for these products by an aggregate market discount rate. Except for air conditioners, the observed discount rates are much higher than real interest rates or the discount rates commonly used in life-cycle cost analysis of consumer choice. They appear to be relatively constant, even though fuel prices escalated rapidly over the time period. We conclude from these results that the market for energy efficiency is not performing well. Several explanations of the under investment in efficiency are proposed: (1) lack of information about the costs and benefits of energy efficiency; (2) prevalence of third party purchasers; (3) unavailability of highly efficient equipment without other features; (4) long manufacturing lead times; and (5) other marketing strategies.

46126 **(LBL—17927) Development of novel lamps for study of enhanced production of resonance radiation by low-density mercury discharges.** Wang, Z.X.; Hollister, D.D.; Berman, S.M. (Lawrence Berkeley Lab., CA (USA)). Jun 1984. Contract AC03-76SF00098. 8p. (CONF-8409108—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016889.

From IEEE-IAS meeting; Chicago, IL, USA (30 Sep 1984).
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A novel mercury-argon discharge tube is described. It incorporates two identical condensation pump cold spots that are employed to determine both the mercury sorption rate and the coefficient of free diffusion for mercury in argon. Equilibration periods for this system are found to depend in part on the temperature difference between the two cold-spot surfaces, and on the separation of these surfaces. Sorption of mercury at the discharge tube's surface, and the subsequent cleanup of the mercury charge, is determined by the time rate of change of the equilibration period. Data accumulated during these tests are incorporated into the design scheme of discharge tubes intended for Zeeman-effect and isotope blending studies described elsewhere.

46127 **(LBL—17998) Electromagnetic interference from fluorescent lighting operated with solid-state ballasts in various sites.** Harms, M.G.; Leung, L.P.; Verderber, R.R. (Lawrence Berkeley Lab., CA (USA)). Jun 1984. Contract AC03-76SF00098. 11p. (CONF-8409108—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016902.

From IEEE-IAS meeting; Chicago, IL, USA (30 Sep 1984).
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Solid-state ballasts with 20 to 30 kHz fundamental frequencies were used to operate fluorescent lamps in office, screen room, and open-field sites. The test equipment and layout are described and the radiated and conducted electromagnetic interference (EMI) data are given for six commercially available ballasts from different manufacturers. EMI data from each location are presented that indicate the suitability of using an office site for future EMI measurements. Broadband EMI data are compared with data from a spectrum analyzer, which justifies the use of an RMS voltmeter in these measurements. A reduction in radiated EMI of 36 dB is achieved by replacing a strip fixture with an EMI-hardened fixture that has a wire grid embedded in its lens. Results of increasing lamp/antenna distance are given; we verify that, for distances greater than 1 meter, the radiated EMI amplitude drops off as a function of $1/d^3$.

46128 **(LBL—18087) Defining daylighting from windows in terms of candlepower distribution curves.** Spitzglas, M. (Lawrence Berkeley Lab., CA (USA)). Jun 1984. Contract AC03-76SF00098. 9p. (CONF-8409108—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016898.

From IEEE-IAS meeting; Chicago, IL, USA (30 Sep 1984).
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This work describes a method for evaluating quantitatively the daylight admittance of windows under any outdoor conditions in terms that make it possible to calculate interior light distribution. The visible daylight flux introduced through a window (or other daylight-admitting aperture) can be considered, from the point of view of the internal space, as being emitted from a point source or from a finite-area uniform source. The photometric properties of those light sources are defined in terms of the well-known candlepower distribution curves. The ways in which this approach can be applied for different window designs are demonstrated.

46129 **(LBL—18139) Air quality issues in ventilation standards.** Nero, A.V.; Grimsrud, D.T. (Lawrence Berkeley Lab., CA (USA)). Jul 1984. Contract AC03-76SF00098. 14p. (CONF-841049—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016899.

From 5. AIC conference on the implementation and effectiveness of air infiltration standards in buildings; Reno, NV, USA (1 Oct 1984).
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An ASHRAE Standard 62-1981 contains two distinct procedures that can be used to set ventilation rates. The first is a prescriptive specification that mandates ventilation rates for particular building types. The second is a performance specification that uses target concentrations of indoor contaminants as the basis for deciding the adequacy of ventilation rates. This paper comments on the latter procedure. Several issues are discussed: (1) the lack of a consistent basis for choosing concentration limits for indoor pollutants, (2) the potential for adverse air quality if the performance specification is adopted in a building, and (3) the practical difficulties in implementing the second option. Several suggestions for improving the Standard are made.

46130 **(NP—4770387) Energy conservation as practiced in building.** (Bundesministerium fuer Raumordnung, Bauwesen und Staedtebau, Bonn (Germany, F.R.)). 1983. 158p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE84770387.

The object of study is heat protection of the enveloping surface of buildings, i.e. both of new and renovated ones. Within an investigation implemented in Baden-Wuerttemberg, an evaluation of heat protection verifications was performed with the intention to show the degree of heat insulation and how the heat-protection regulation was implemented. The overall result is that heat insulation of the building's enveloping surface can be effected mostly with no problem. Roofs and base surfaces, however, should be better insulated according to the evaluation. Various deficits in implementation and building are mentioned with resultant conclusions and recommendations being drawn.

46131 **(NYSERDA—84-13) Advanced oil-fired heating systems demonstration.** Herlihy, J. (Brown (Dayton T.), Inc., Bohemia, NY (USA)). May 1983. Contract AC02-76CH00016. 137p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84017216.

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The overall objective of this program was to perform detailed engineering evaluations of the performance of advanced oil-fired heating systems under actual field conditions. The equipment selected for field evaluation were systems that had performed well during laboratory testing and also were believed to have a good potential for commercialization. An additional objective was to determine how well the Annual Fuel Utilization Efficiency (AFUE) determined by laboratory testing utilizing the Department of Energy labeling procedure compared with seasonal efficiency measured by enthalpy balance during laboratory and field tests. The four phases of the program described are: evaluation of efficiency labeling procedures, evaluation of a blue-flame boiler, evaluation of a low-mass boiler, and evaluation of a warm-air condensing furnace.

46132 **(ORNL/CON—164) Use of electricity billing data to determine household energy use fingerprints.** Hirst, E.; Goeltz, R.; White, D. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 43p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017470.

Ways to analyze billing data are discussed. The starting point for these analyses is a method developed at Princeton University. Their Scorekeeping model permits decomposition of total household energy use into its weather- and nonweather-sensitive elements; the weather-sensitive portion is assumed proportional to heating degree days. The Scorekeeping model also allows one to compute weather-adjusted energy consumption for each household based on its billing data and model parameters; this is the model's estimate of annual consumption under long-run weather conditions. The methods discussed here extend the Scorekeeping results to identify additional characteristics of household energy use. In par-

ticular, the methods classify households in terms of the intensity with which the particular fuel is used for space heating (primary heating fuel vs supplemental heating fuel vs no heating at all with the fuel). In addition, households that use the particular fuel for air conditioning are identified. In essence, the billing data and model results are used to determine household energy use fingerprints. The billing data and model results can also be used to identify and correct anomalous bills. The automated method discussed here identifies anomalously high or low utility bills, which are then dropped before re-estimation of the Scorekeeping model parameters. Alternatively, a pair of bills may be combined if one is very high and a temporally adjacent bill is very low. The Scorekeeping model is then re-estimated after the two bills are combined into one. The methods permit careful examination and analysis of changes in energy use from one year to another.

46133 **(ORNL/Sub—80-61619/1) Development of a Braun Linear Engine-Driven, heat-actuated heat pump. Final report.** (Tectonics Research, Inc., Minneapolis, MN (USA); Honeywell, Inc., Roseville, MN (USA). Technology Strategy Center; Honeywell Corporate Technology Center, Bloomington, MN (USA)). Jul 1984. Contract AC05-84OR21400. 136p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84016647.

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A summary of component analyses, design and tests, and a description of breadboard design, fabrication, test and results are included.

46134 **(WAOENG—84-05) Energy efficient home construction techniques manual.** Lenchek, T.; Mattock, C.; Fedoruk, R.; Rabbe, J. (Balance Associates, Seattle, WA (USA); SAR Ltd., Vancouver, British Columbia (Canada); Cooperative Design, Seattle, WA (USA)). Mar 1984. Contract AI79-83BP13483. 326p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE84017000.

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This manual was designed to be used by those builders participating in a series of training sessions on energy efficient housing construction techniques. It is a compendium of construction approaches for homes built under the state's Energy Efficient Home Demonstration Program (EEHDP).

46135 **(WAOENG—84-09) Residential Energy Evaluation Program: evaluation and summary. Final report.** Patton, A.M.; Parker, J.F. (Washington State Energy Office, Olympia (USA)). Mar 1984. Contract AC79-82BP34623;FG06-79R000003. 242p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE84017146.

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The two components of the Residential Energy Evaluation Program (REEP); the rating method and the process to implement the rating method, are described. WSEO's role as coordinator of the REEP evaluation is described. The evaluation objectives and the various evaluation perspectives, i.e., what is being evaluated and why, are described. Each of the major evaluation activities is reviewed as it relates to the WSEO evaluation plan. Presentation of findings from evaluation activities are included. Conclusions and recommendations of WSEO regarding both the rating method and its implementation are presented. Recommendations of WSEO for future research and texts of evaluation studies are included.

46136 **Field test and assessment of thermal energy storage for residential heating.** Hersh, H. (Argonne National Laboratory, Argonne, IL). *Alternative Energy Sources;* 614-615(Dec 1983). (CONF-831205—).

From 6. Miami international conference on alternative energy sources; Miami Beach, FL, USA (12 Dec 1983).

Thermal energy storage (TES) heating units can be connected to the utility grid to accept electricity only during utility off-peak periods and yet provide round-the-clock comfort heating. Their use by an increasingly larger part of the electric-heat market could provide economic and oil-saving benefits. A field test was carried out over two full heating seasons in Vermont and Maine at 45 TES sites and 30 control sites heated by electric baseboard heaters. The TES users were billed under applicable time-of-day (TOD) rates. All sites were instrumented, and measurements of inside and outside temperatures and electrical energy consumption for heating were made and recorded every 15 min. Analysis of the data has led to the following findings and conclusions: Overall technical performance of the TES units was good under extreme weather conditions. Annualized energy use was the same for the TES and the control households. Proper sizing of the storage systems is much more important for storage heaters than for nonstorage heaters. TES users were satisfied with performance. Electric-heat bills were much lower for TES users. Occupancy effects were large and caused wide variations in energy consumption on days that had the same number of heating degree-days. The individual building heat loss determined experimentally from an analysis of the actual energy consumption per heating degreeday was 30% to 50% smaller than that determined by a walkthrough energy audit.

3202 Transportation

REFER ALSO TO CITATION(S) 32020046119, 46162

46137 **(SAND—84-0838) Automatic land vehicle navigation using road map data.** Schindwolf, R. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1984. Contract AC04-76DP00789. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017178.

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A land navigation system has been developed that provides accurate navigation data while it is traveling on mapped roads. The system is autonomous and consists of a simple dead-reckoning navigator that is updated with stored road map data. Simulation and preliminary test results indicate that accuracies on the order of 50 feet can be achieved. Accuracy is independent of time.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 32030045368, 45369, 45370, 45371, 45372, 45395, 45444, 45684, 45881, 45902, 45903, 46082, 46119, 46159

46138 **(AD-A—141363/2) Fuel conservation and construction equipment.** Falchetta, V.T. (Army Belvoir Research and Development Center, Fort Belvoir, VA (USA)). Feb 1984. 33p. NTIS, PC A03/MF A01.

The Army's energy conservation goals and methods for estimating fuel requirements as they relate to construction equipment are identified. The impact of the R and D Center's current procurement strategy and TECOM's test procedures on the Construction Engineering Division's energy conservation program is discussed. Existing methods for determining fuel consumption are identified and evaluated.

46139 **(BNL—51770) Condensing heat exchanger systems for residential/commercial furnaces and boilers. Phase III.** Razgaitis, R.; Ball, D.A.; Lux, J.J. Jr.; White, E.L.; Markle, R.A.; Bradbury, E.J.; Sekercioglu, I.; Locklin, D.W. (Battelle Columbus Labs., OH (USA)). Feb 1984. Contract AC02-76CH00016. 379p. NTIS, PC A17/MF A01; 1; GPO Dep. File Number DE84017183.

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Problems in the design of condensing heat exchangers and the project history and scope are described. The following are included: materials testing apparatus and method, metals testing, polymers testing, ceramics testing, condensate characterization for a No. 6 oil-fired boiler, condensing heat transfer, and the discussion of overall perspective of experimental findings. (MHR)

46140 (CONF-8203178—, pp 82-85) **Energy from waste water and sewage sludge.** Fleckseder, H. Jul 1982. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number TI84770366.

From 10. Salzburg economic inquiry; Salzburg, Austria (4 Mar 1982).

It is discussed how to reduce liquid wastes from paper industry coinciding with rising of industrial process efficiency. Beyond it, the water power of the river Salzach forming the border of Austria and Bavaria could be more exploited if water quality gets better. For both aims, improving water quality and energy conservation, it is also discussed to generate power from industrial and municipal waste water by using sewage gas for fuel. The low population equivalence (ca. 300,000) of water treatment company in Salzburg does not yet promise profitable operation.

46141 **(DOE/NASA—0302-1) RC-1 organic Rankine bottoming cycle for an adiabatic diesel engine. Final report.** DiNanno, L.R.; DiBella, F.A.; Koplow, M.D. (Thermo Electron Corp., Waltham, MA (USA)). Dec 1983. Contract AI01-80CS50194. 122p. (NASA-CR—168256; TE—4322-215-83). NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84016861.

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A system analysis and preliminary design were conducted for an organic Rankine-cycle system to bottom the high-temperature waste heat of an adiabatic diesel engine. The bottoming cycle is a compact package that includes a cylindrical air-cooled condenser-regenerator module and other unique features. The bottoming cycle output is 56 horsepower at design point conditions when compounding the reference 317 horsepower turbocharged (TC) diesel engine with a resulting brake specific fuel consumption of 0.268 lb/hp-hr for the compound engine. The bottoming cycle when applied to a turbocompound (TCPD) diesel delivers a compound engine brake specific fuel consumption of 0.258 lb/hp-hr. This system for heavy-duty trnsport applications uses the organic working fluid RC-1, which is a mixture of 60 mole percent pentafluorobenzene (PFB) and 40 mole percent hexafluorobenzene (HFB). Included in these 1983 work efforts was the thermal stability testing of the RC-1 organic fluid in a dynamic fluid test loop that simulates the operation of Rankine-cycle. More than 1600 hours of operation were completed with results showing that the RC-1 is thermally stable up to 900°F. This report describes the work performed for one of the multiple contracts awarded under the Department of Energy's Heavy-Duty Transport Technology Program.

46142 **(EGG—2344) Technology research needed in industrial combustion processes.** Pohl, J.H.; Lee, J.; Clough, J.; Dan, J. (Energy and Environmental Research Corp., Irvine, CA (USA)). Sep 1984. Contract AC07-76ID01570. 93p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017455.

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This report reviews a number of potential techniques industry can use to save industrial energy in combustion processes or to replace oil and gas by solid fuels. In each case, energy savings are estimated, barriers to implementing the process identified and research needs specified. Finally, based on estimated numerical criteria, research priorities are assigned to those techniques which can yield the largest savings of oil and natural gas in the industrial sector with the least investment. Techniques considered are largely limited to those which can be implemented in industry within five years and discussion of longer range technology is limited. Two priority research topics were identifed: (1) encourage the use of industrial waste products; and (2) encourage the use of oxygen enrichment. Oxygen enrichment was probably the most effective way to achieve energy savings of those investigated.

46143 **(EGG-M—24383) Determination of optimum Curie point as a function of source and sink temperatures for magnetic heat pumps.** Van Haaften, D.H.; Mills, J.I. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 4p. (CONF-840804—45). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016995.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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Magnetic heat pump cycles are being investigated to determine their feasibility in industrial applications. This analysis has noted significant improvements in the performance of these cycles when the magnetic refrigerant's Curie temperature is 5 to 15 K above the average of the sink and load temperatures. When the magnetic cycle's operating temperatures are carefully matched with the magnetic core material's Curie temperature, cycle performance can approach Carnot efficiencies.

46144 **(EGG-M—24483) Magnetic heat pump cycles for industrial waste heat recovery.** Mills, J.I.; Kirol, L.D.; Van Haaften, D.H. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 7p. (CONF-840804—46). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017016.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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Magnetic heat pumps utilize entropy reductions which occur upon magnetization (magnetocaloric effect) in thermodynamic cycles. Magnetic equivalents of Brayton and Ericson (or Stirling) cycles are possible. Magnetic heat pumps with gadolinium working material perform significantly better than conventional equipment. Working materials appropriate for industrial heat pump applications (400 to 500 K) have been identified, but performance is not as good as with gadolinium. When better performing high-temperature materials are identified, feasible industrial magnetic heat pumps should be possible.

46145 **(EPRI-EM—3645) Microwave power in industry. Final report.** Smith, R.D. (Thermo Energy Corp., Palo Alto, CA (USA)). Aug 1984. 111p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920528.

This report is written to assist utility staff engineers in searching for new applications of industrial microwave power. Microwaves, so common in the home, are little used in industry because the economics of their application are not well understood. In this report, successful applications are reviewed and the reasons for their success are described. Based upon the results of these applications, broad guidelines for the success of microwave applications are formulated for use as a screening tool when considering new applications. Finally, emerging applications considered promising are individually discussed and weighed. Four successful application of microwave power were examined in detail to determine the reasons for their success. The applications examined were as follows: frozen food tempering; rubber vulcanization; bacon cooking; and pasta drying. Microwaves are a noble form of energy that is very expensive so they must be applied carefully and sparingly to do only those tasks at which they excel. Using these guidelines, utility engineers can direct their industrial customers into applications that have a good chance of economic reward and avoid dead-end applications with no payout. Future prospects for microwave power look attractive in the chemical processing industries, although there are few applications at this time. Much work has been done on agricultural applications, but the economics must still be proven attractive. Applications such as nuclear waste disposal may be attractive to utilities. Coal beneficiation has received development funding but the economics are as yet unproven. Microwave power technology is well proven but its high equipment cost and high operating costs demand that full use of its productivity be made if the application is to be economically sound. 43 references, 15 figures, 5 tables.

46146 **(ERATL—84/30) Power factor controllers: their markets and performance.** (ERA Technology Ltd., Leatherhead (UK)). 1984. 237p. NTIS, PC $1,500.00.

The four volume set consists of the following reports on power factor controllers: (1) Their Markets and Performance, First Laboratory Report; (2) Their Markets and Performance, Second Laboratory Report; (3) Applications and Marketing Report; and (4) An Assessment of the Performance of Power Factor Controllers, Executive Summary.

46147 **(ERATL—84/30/2) Power factor controllers: their markets and performance. The first laboratory report.** Locke, D.H. (ERA Technology Ltd., Leatherhead (UK)). 1981. 85p. (ERA—81-139). NTIS, PC $1,500.00.

A power factor or energy saving controller is claimed to save energy if it is inserted in the supply to an induction motor that

is running at less than full load. This report describes the first set of laboratory experiments carried out on a number of three phase devices to assess their performance. Three controllers were tested, one American and two British with a standard 3 kW, 415 V, 4-pole induction motor. This report is one of a series.

46148 **(ERATL—84/30/3) Power factor controllers: their markets and performance. The second laboratory report.** Leung, S.W.; Kalsi, R.S. (ERA Technology Ltd., Leatherhead (UK)). 1982. 52p. (ERA—82-39). NTIS, PC $1,500.00.

Power factor or energy saving controllers are claimed to save energy when inserted in the supply to an induction motor that is running at less than full load. This report describes the second set of laboratory tests carried out on different three-phase controllers to assess their performance. Two power factor controllers were tested, one American and one British with standard 5.5 kW, 415 V, 4-pole induction motor. The study included the assessment of the performance of the power factor controller, measurement of temperature rise in different parts of the induction motor, distortion in kWh meter readings, and their effect of the power factor controllers. Comparison in various aspects are made between the power factor controller, variac simulation and the direct-on-line supply. This report is one of a series.

46149 **(ERATL—84/30/4) Power factor controllers: their markets and performance. Applications and marketing report.** Rattle, J.D. (ERA Technology Ltd., Leatherhead (UK)). 1983. 87p. (ERA—81-140). NTIS, PC $1,500.00.

The report presents the findings of a UK market investigation into the potential application for three phase power factor controllers (pfc's) in the range 0.375-150 kW. It looks in detail at various pieces of equipment which are commonly driven by case rotor induction motors (eg pumps, fans, compressors, machine tools) and provides estimates of the numbers of each such type of equipment in use in UK industry broken down by power band. It also provides guidelines concerning annual usages of such pieces of equipment and the motor loadings commonly associated with them. The importance of electricity as a source of energy and the pattern and type of motive power usage is then presented for a wide range of industry sectors in an attempt to identify the most promising prima facie markets for the pfc concept of motor control and energy saving. The report is one of a series.

46150 **(NP—4770369) Heat release and cooling water problems of the chemical industry.** (Verband der Chemischen Industrie e.V., Frankfurt am Main (Germany, F.R.)). 1984. 34p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84770369.

As far as technically possible and economically feasible, the waste heat of production processes is recovered and utilized. This applies to municipal waste management, to the chemical industry and to power plants. This way, thermal pollution of rivers is kept at a minimum and removal of cooling water is reduced.

46151 **(NP—4770395) Research on the production of very large size bricks with high thermal insulation values.** (Fuchs und Co. A.G. fuer Elektrodraht-Erzeugung und Maschinenbau, Graz (Austria)). 1984. 131p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84770395.

Better thermal insulation in domestic buildings requires the production of bricks with a higher porosity, on the other hand one aims at reducing the production costs for drying and burning by adding low-cost combustible material to the brick material mix. These methods are known but present certain problems, when used in new industrial manufacturing processes. Reasons: size of the normal bricks (10 to 20 times larger as the size in the past); higher production output in less time, separation of the added combustible material was very hard to realise in both cases. The task of this study was to find ways and means to manufacture large-size bricks with modern production methods while adding waste products consisting of combustible material for enhancing pore formation and as energy supply in brick production.

46152 **(NP—4901775) Alternative energy heating of dairy process water. Final report, March 1, 1978-December 31, 1980.** Elwell, D.L.; Roller, W.L. (Ohio Agricultural Research and Development Center, Wooster (USA)). Jan 1981. 44p. Dept. of Development, Div. of Energy, 65 E. State St., Columbus, OH 43215. File Number TI84901775.

The system made use of three alternative energy sources. First, heat was recovered from the milk. Second, solar energy was collected, and third, off-peak electric heating was used as a back-up energy source during periods of cloudy weather. Heat was recovered from the milk directly through an in-line heat exchanger and indirectly from the bulk-tank, milk refrigeration compressors. It was found that refrigeration heat recovery provided, for the 110 to 120 cow herd studied, 1.6 x 10^5 Btu/day in direct energy for heating replacement and that, at 4 cents/kWh, this represented a savings of $700/yr. From this, it was concluded that milk refrigeration heat recovery equipment can pay for itself in less than one year for a milking herd of 250 head or more and that this period will increase to roughly five years as herd size is reduced to 50 head.

46153 **(NP—4901862) Saline water conversion research. Progress report, July 1, 1982-June 30, 1983.** (California Univ., Richmond (USA). Water Thermal and Chemical Technology Center; California Univ., Los Angeles (USA). School of Engineering and Applied Science). Jul 1983. 67p. NTIS, PC A04/MF A01. File Number DE84901862.

This report describes the activities of the University's saline water conversion research program. The following programs are described: (1) non-convective solar ponds in California; (2) Rankine cycles with two-component working fluid for power production from solar ponds or waste heat; (3) evaporation studies; (4) CO_2 regeneration of weak-acid ion exchangers; (5) selenium removal from drinking water; (6) calcium removal from agricultural wastewater; (7) polarization characteristics of electrodialysis membranes; (8) agricultural wastewater processing for reuse; (9) use of desalination brine in salt-gradient solar ponds; (10) scale control studies; (11) saline water conversion by semipermeable membranes; (12) corrosion of metals in seawater; (13) enhanced-surface tubes for horizontal evaporation processes; and (14) mass transfer in membranes. (ACR)

46154 **(PNL—5195) ECUT energy data reference series: boilers.** Chockie, A.D.; Johnson, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76RL01830. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017294.

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Information on the population and fuel consumption of water-tube, fire-tube and cast iron boilers is summarized. The use of each boiler type in the industrial and commercial sector is examined. Specific information on each boiler type includes (for both 1980 and 2000) the average efficiency of the boiler, the capital stock, the amount of fuel consumed, and the activity level as measured by operational load factor.

46155 **A refined computer program for the transient simulation of ground coupled heat pump systems.** Andrews, J.W.; Metz, P.D.; Saunders, J.H. (Brookhaven National Laboratory, Upton, NY). pp 529-534 of Solar Engineering -- 1984. Yogi Goswami, D. New York, NY; A.S.M.E. (1984). (CONF-840402—).

From 6. annual ASME Solar Energy Division technical conference; Las Vegas, NV, USA (10 Apr 1984).

Since 1978 a research program at Brookhaven National Laboratory (BNL) has investigated the use of the earth as a heat source/sink or storage medium for various heat pump-based space conditioning systems. As part of this research program, a computer program GROCS (GROund Coupled Systems) has been developed to model the behavior of ground coupling devices. GROCS has been integrated with TRNSYS, the solar system simulation program, to permit the simulation of complete ground coupled heat pump systems. Experimental results have been compared to GROCS simulation results for model validation. The model was found to have considerable validity. This paper describes a recently

refined version of the GROCS-TRNSYS program developed to model vertical or horizontal earth coil systems, taking into account system cycling. The design of the program and its interaction with TRNSYS are discussed. GROCS-TRNSYS results are compared to exact analytical results for program validation.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 32060045881, 46132, 46140

46156 **(ANL/CNSV-TM—137) Energy from municipal waste: state-of-the-art and emerging technologies - workshop proceedings.** Brooks, C. (comp.). (Argonne National Lab., IL (USA)). Feb 1984. Contract W-31-109-ENG-38. 268p. (CONF-831151—). NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE84015454.

From State-of-the-art and emerging technologies: a waste-to-energy workshop; Chicago, IL, USA (28 Nov 1983).

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Separate abstracts were prepared for individual papers. (MHR)

46157 **(DOE/RA/50403—1) Waste to energy resource recovery project of the Municipality of Caguas, Puerto Rico. Final report.** (Caguas, Municipality of, Puerto Rico). Oct 1983. Contract FC02-80RA50403. 142p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84012066.

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The work performed included the selection of a construction site, execution of a system procurement process, selection of appropriate technology, negotiations with the local electric utility company for the sale of electricity, waste characterization, relevant data collection, and the preparation of an environmental impact report. Although the final negotiations leading to the construction of said facilities have not concluded, the necessary technical, financial and legal groundwork has been laid for the Municipality to be able to achieve the intended goal in a near future.

46158 **(PB—84-189513) Hand dismantling and shredding of Japanese automobiles to determine material contents and metal recoveries. Report of investigations/1984.** Sterner, J.W.; Steele, D.K.; Shirts, M.B. (Bureau of Mines, Salt Lake City, UT (USA). Salt Lake City Research Center). 1984. 32p. (BM-RI—8855). NTIS, PC A03/MF A01.

The Bureau of Mines conducted studies on four makes of Japanese automobiles, three 1981 and one 1982 model years, received from three manufacturers to determine if their materials composition would present problems to the current technology used to process junk automobiles for metal recovery. One of each make of automobile was hand-dismantled to determine the materials composition. In addition, two nearly identical automobiles of each make were shredded at a commercial operation where all metal products and rejects were collected for analysis to determine metal and nonmetal distribution. The average weight of the four automobiles to be dismantled, less batteries, tools, and fluids, was 1,938.3 lb. There were no materials used in the manufacture of the late model Japanese automobiles that should present handling or processing problems to the steelmaking or secondary metal recyclers.

46159 **Zigzag configurations and air classifier performance.** Peirce, J.; Wittenberg, N. (Dept. of Civil and Environmental Eng., Duke Univ., Durham, NC). *Journal of Energy Engineering;* 110: No. 1, 36-48(Mar 1984).

The fundamental aspects of zigzag air classifier configurations are studied in terms of the design and operation of a waste-to-energy production facility. The development of a method of performance evaluation defined by operating range is examined. Historically, air classification has been used in industry and agriculture in mineral extraction, limestone sizing, and seed and grain cleaning. However, the adaption of air classifiers to resource recovery and waste-to-energy production facilities presents new problems due to the complex and variable nature of the wastes. A series of configurations providing a continuous range of zigzag classifier shape components are tested. Each configuration is evaluated to determine its efficiency of separation, and sensitivity to operating air speeds. Results indicate that the configuration of a zigzag classifier does not influence its peak efficiency of separation. However, findings point to distinct limits on operating parameters which lead to peak efficiencies for the different configurations. These operating range values represent the sensitivity of the air classifier to changes in the air flow. A major finding concerns the effect of configuration on the particle size distribution observed in the material exiting the classifier: smaller particles appear to be influenced by configuration changes and larger particles do not. A new method for classifer performance evaluation is developed and applied.

46160 **Photovoltaics and electric utilities.** Bright, R.N.; Leigh, R.W. (Department of Applied Science, Brookhaven National Laboratory, Upton, NY). *Energy (Oxford);* 9: No. 2, 125-147(Feb 1984).

The authors determine the long-term value of grid-connected, residential photovoltaic (PV) systems. The value of the PV electricity is defined as the full avoided cost, consistent with the Public Utilities Regulatory Policies Act of 1978. A case study approach to three utility systems is used. The avoided cost is computed using a long range utility planning approach to measure revenue requirement changes in response to the time-phased introduction of PV systems into the grid. The changing value of PV electricity over a 20-year period from 1985 is presented, and the fuel and capital savings due to PV are analyzed and translated into a measure of breakeven capital investment.

3209 Education And Public Relations

REFER ALSO TO CITATION(S) 32090045746, 46125, 46135

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 33010046141, 46173

46161 **(DOE/NASA—0304-1) Waste heat recovery from adiabatic diesel engines by exhaust-driven Brayton cycles.** Khalifa, H.E. (United Technologies Research Center, East Hartford, CT (USA)). Dec 1983. Contract AI01-80CS50194. 108p. (NASA-CR—168257). NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85001608.

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This report presents an evaluation of Brayton Bottoming Systems (BBS) as waste heat recovery devices for future adiabatic diesel engines in heavy duty trucks. Parametric studies were performed to evaluate the influence of external and internal design parameters on BBS performance. Conceptual design and trade-off studies were undertaken to estimate the optimum configuration, size, and cost of major hardware components. The potential annual fuel savings of long-haul trucks equipped with BBS were estimated. The addition of a BBS to a turbocharged, nonaftercooled adiabatic engine would improve fuel economy by as much as 12%. In comparison with an aftercooled, turbocompound engine, the BBS-equipped turbocharged engine would offer a 4.4% fuel economy advantage. It is also shown that, if installed in tandem with an aftercooled turbocompound engine, the BBS could effect a 7.2% fuel economy improvement. The cost of a mass-produced 38 Bhp BBS is estimated at about $6460 or $170/Bhp. Technical and economic barriers that would hinder the commercial introduction of bottoming systems were identified.

46162 **(NP—4770374) Concept of a compound drive for commercial vehicles.** Gwinner, D. (Daimler-Benz A.G., Stuttgart (Germany, F.R.)). Feb 1983. 42p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84770374.

About 60 to 80% of the fuel energy supplied to a diesel engine are lost as oil- and cooling water heat and exhaust gas de-

pending on the phase of operation. Part of this exhaust gas energy can be converted into mechanical energy directly or indirectly and made available for further use provided a further energy converter, i.e. an exhaust gas turbine, is attached via a reduction gear to the diesel engine. A turbocompound diesel engine long-distance lorry was used for calculating the highest possible fuel savings on the distance Netherlands-North of Italy and back. Explanations are given on the idealized process management of the chosen steam aggregate, design of components, calculation of the real processes, and fuel saving. Profitability calculations prove that turbocompound diesel engine operation for long-distance lorries will not pay under present European economic boundary conditions.

46163 **A fuel injection transducer and controller.** Oren, D.; Ferguson, C.R.; Wahiduzzaman, S. (Purdue University, School of Mechanical Engineering). *SAE (Society of Automotive Engineers) Special Publication;* **SP-557**: 21-30(Oct 1983).

A fuel injection meter and controller has been developed which (1) measures the instantaneous injection rate and the total mass of fuel injected, and (2) controls the mass of fuel injected and injection pressure. The injection rate is computed from instantaneous measurements of the velocity of a pumping plunger and the pressure of fuel injection. A mathematical model of the meter and controller was developed to futher the understanding of various design and operating parameters on the injection rate. Compressibility of the fuel is accounted for. Good agreement is realized between numerically computed injection pressure and rate histories with corresponding experimental results.

46164 **Measurements and predictions of the precombustion fluid motion and combustion rates in a spark ignition engine.** Witze, P.O.; Borgnakke, C.; Martin, J.K. (Sandia National Laboratories, Livermore, CA). *SAE (Society of Automotive Engineers) Preprint;* **SAE-831697**: 12(Oct 1983). (CONF-8310223—).

From Society of Automotive Engineers meeting; San Francisco, CA, USA (31 Oct 1983).

Laser Doppler velocimeter results are presented for the mean velocity and turbulence intensity measured in a motored research engine. The compression of complex bulk motions created during induction produces turbulence as the piston approaches top dead center. The turbulence field is shown to be isotropic but nonhomogeneous. A zero-dimensional computer simulation based on an averaged k-E model is shown to adequately predict the decay of turbulence at a point in the flow after the production phase is completed. Cylinder pressure measurements were recorded for homogeneous stoichiometric combustion for a range of engine speeds and ignition locations. A two-zone (burned and unburned gases) thermodynamic model accurately predicts the measured pressure histories when the turbulence results determined from the motored tests are used to establish initial conditions for the combustion model.

46165 **Coal-fueled diesel engines.** Robben, F. (Lawrence Berkeley Laboratory, University of California). *SAE (Society of Automotive Engineers) Preprint;* **SAE-831747**: 12(Oct 1983). (CONF-8310223—).

From Society of Automotive Engineers meeting; San Francisco, CA, USA (31 Oct 1983).

The use of pulverized coal as a fuel for diesel engines can be a practical and efficient means of substituting coal for oil and gas in medium size applications such as railroad locomotives, ships and industrial stationary and co-generation power. These applications could result in reducing the oil and gas consumption of the U.S. by 2% to 10%, depending on the market penetration. The extensive German development of the use of pulverized coal in diesels during the period 1930 to 1944 demonstrated that coal-fueled diesels can be a practical heat engine. Although the German development used dry pulverized coal as a fuel, it now appears that beneficiated coal-water slurries will be a more practical and economical form of fuel. Operation on coal-water slurries is likely to pose some problems with ignition and particle agglomeration which require investigation. In this paper the background on coalfueled diesel engines is reviewed and the potential applications and benefits are briefly presented. The technical problems in developing a coal-water slurry diesel are reviewed and possibilities for overcoming these problems are presented and discussed. A coal-fueled diesel research and development program is recommended.

46166 **Investigations of coal-derived liquid fuels in diesel engines.** Utvik, D.H.; Jaminet, J.F.; Spadaccini, L.J. (United Technologies Research Center). *SAE (Society of Automotive Engineers) Special Publication;* **SP-557**: 31-46(Oct 1983).

Results of a program conducted to investigate the operation of a medium-speed stationary diesel engine on coal-derived liquid (CDL) fuels are presented. The overall objectives of the program were to evaluate promising techniques for effective utilization of three middle-distillate alternative fuels, namely SRC-II, Exxon Donor Solvent and H-Coal, without adversely affecting engine performance and operation, and to formulate control system algorithms. Investigations of fueling techniques such as on-line blending with diesel fuel, fumigation and the addition of ignition accelerants were conducted as well as investigations of such engine test variables as injection timing and pressure, inlet air temperature and inlet air pressure (i.e., turbocharger boost). In general, it was concluded that diesel engine operation with CDL fuel blends is possible over a wide range of speed and load conditions. Strategies found useful for extending diesel engine operation with CDL fuels include fumigation, inlet air preheat, turbocharger boost and ignition accelerants.

46167 **A time-dependent spatial model for radiant heat transfer in diesel engines.** Chapman, M.; Aghan, A.; Friedman, M.C. (S-CUBED). *SAE (Society of Automotive Engineers) Special Publication;* **SP-557**: 13-20(Oct 1983).

The authors have developed a fully three-dimensional spatial model of the instantaneous radiation heat transfer in direct ignition diesel engines. The model is based on the assumption that the primary source of radiation is from the soot formed on the fuel-rich side of the combusting spray plumes. The model then calculates viewfactors to the various regions from the evolving plume using a spray correlation model. The soot is assumed to be a grey body radiating through an optically thin medium to the relatively cool components of the combustion chamber. Preliminary calculations using the model indicate that there are significant spatial and temporal variations in the incident radiation on various regions in the combustion chamber. These calculations were performed for a geometry and operating conditions of a production turbocharged medium speed engine at full load conditions.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 33030046041

3304 Hybrid Systems

REFER ALSO TO CITATION(S) 33040046162

3307 Emission Control

46168 **(PB—84-183110) Study of exhaust emissions from eighty-four high mileage 1980 passenger cars. Technical report.** Shelton, J.C. (Environmental Protection Agency, Ann Arbor, MI (USA)). Dec 1983. 36p. (EPA-AA-TEB—84-2). NTIS, PC A03/MF A01.

This paper describes the results of an exhaust emission testing program conducted on eighty-four 1980 model year passenger cars. The primary purpose of this program was to examine the emission performance of high-mileage vehicles. Secondary objectives included an assessment of the condition and performance of the emission-related components and the collection of information for development and improvement of I/M programs.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 33080045702

46169 **(AD-A—090977) Influence of mico fuels on engine performance, exhaust emissions, and endurance.** Tataiah, K.; Lestz, S.J. (Southwest Research Inst., San Antonio, TX (USA). Army Fuels and Lubricants Research Lab.). Dec 1979. Contract AC22-78ET00269. 87p. (AFLRL—125). NTIS, PC A05/MF A01. File Number TI84016849.

The influence of Micronized Ccal-in-Oil (MICO) fuels on engine performance and exhaust emissions was experimentally studied in a single-cylinder Hatz diesel engine. One of these fuels, which contained 20 wt % coal, was also examined for its effects on engine endurance and wear in a four-cylinder Mercedes diesel engine. The performance and emissions tests were conducted at twelve different steady-state conditions covering the operating speed-load range of the engine. In each test, the exhaust emissions (including particulates, sulfates, and smoke), crankcase blowby, and temperatures were measured, and brake thermal efficiency and air-fuel ratio were calculated. The results obtained with the single-cylinder engine indicate that the coal in MICO fuel hinders the combustion of the diesel component and decreases the overall brake thermal efficiency of the engine. Although the coal reduces the consumption of diesel fuel component, the total energy consumption is higher. The exhaust emissions (unburned hydrocarbons, carbon monoxide, oxides of nitrogen, particulates, smoke, and sulfates) increased with the use of coal in the fuel. MICO fuel which contained 2.8 wt % emulsified water further increased the HC, CO, particulates, and smoke emissions. However, the water reduced NO/sub x/ and had no effect on sulfate emissions.

46170 **(AD-P—003153/4) Predicted TF41 performance with the AGARD research fuel.** Peters, J.E. (Illinois Univ., Urbana (USA). Dept. of Mechanical and Industrial Engineering). 1984. 8p. NTIS, PC A02/MF A01.

Calculations are presented to predict the performance of an alternative fuel in a conventional gas turbine combustor. Existing data for fuel effects on the Detroit Diesel Allison TF41 combustor, a can-annular burner, are correlated with the semi-empirical characteristic time model. The correlations are used to predict the ignition, stability and combustion efficiency performance of a proposed alternative fuel, the AGARD Research Fuel, in the TF41 combustor. Compared to standard NATO F-40 and F-35 fuels the alternative fuel will provide similar combustion efficiency levels, reduced flame stability and significantly degraded ignition performance.

46171 **(CONF-840470—1) Natural gas the new locomotive fuel.** Tuskey, L.W. (Northern States Power Co., Minneapolis, MN (USA)). 1984. 29p. NTIS, PC A03/MF A01. File Number DE84901824.

From Nonpetroleum vehicular fuels IV symposium; Arlington, VA, USA (16 Apr 1984).

This is a report on modification of a locomotive diesel engine to a dual-fuel engine to determine if the dual fuel engine in railway service will provide high performance, lower fuel and maintenance costs. After the locomotive was modified and the new governor and linkage were installed by General Motors at the BN's Northtown Diesel Shop near Minneapolis, the locomotive went through startup procedures. General Motors participated in startup. Some calibration, adjustments and minor piping changes were required but in general the problems encountered in startups were quite insignificant. The locomotive was connected to the load box (static test) during startup and at 720 RPM exceeded the required output for this test as established by the parties. Operation on straight oil over the range from idle through No. 8 throttle notch and on dual fuel from No. 5 through No. 8 throttle notch was smooth as was the transfer from oil to gas and from gas to oil. The engine exhaust on straight oil was almost clear but on gas it was totally clear. 16 references, 3 figures, 4 tables.

46172 (CONF-8203178—, pp 64-74) **Energy from biomass desired alcohol.** Kopez, H. Jul 1982. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number TI84770366.

From 10. Salzburg economic inquiry; Salzburg, Austria (4 Mar 1982).

The development of Austria from a cereals importing to an exporting country, caused above all by productivity rise, is reviewed. In a scenario the cultivation of cereals is complemented by energy supplying biomass plantations like beets, millet, rape and wood. Till 1990 8% alcohol shall be added to gasoline and vegetable oil to diesel-fuel.

46173 **(DOE/CE/50036—T6) Research and development of alcohol fuel usage in spark ignited engines. Monthly progress report, August 1984.** (Santa Clara Univ., CA (USA)). Aug 1984. Contract FG03-84CE50036. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016958.

Progress is reported on the following: computer modeling of cold starting, cold start droplet preparation studies, dissociated methanol for cold starting, corrosion and wear study, smog chamber experiments and aldehyde measurements, and Toyota Cressida tests. (MHR)

46174 **(SERI/TP—234-2245) Dissociated methanol vehicle test results.** Finegold, J.G. (Solar Energy Research Inst., Golden, CO (USA)). May 1984. Contract AC02-83CH10093. 11p. (CONF-840543—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84004507.

From International symposium on alcohol fuels technology; Ottawa, Ontario, Canada (21 May 1984).

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This paper presents the results of chassis dynamometer testing of a 1980 Chevrolet Citation modified to run on dissociated methanol. Data are presented on the composition of the dissociated methanol gas during steady-state operation, vehicle fuel consumption during steady-state and transient operation, and exhaust emissions during transient operation. During low speed, low load operation there are significant amounts of unconverted methanol and side products to the desired dissociation reaction. Despite this, fuel economy improvements over baseline gasoline operation are high. Fuel economies of 13.3 km/L (31.3 mpg) and 11.4 km/L (26.8 mpg) were obtained at steady speed road load conditions of 65 km/h and 90 km/h respectively. Methanol fuel economy over the EPA '74 CVS hot start city driving cycle was 7.74 km/L (18.2 mpg). Methanol fuel economy over the EPA highway fuel economy test was 10.2 km/L (24.0 mpg).

36 MATERIALS

REFER ALSO TO CITATION(S) 36000045988, 46433

46175 **(CONF-840787—1) Computational models of crystals.** Busing, W.R. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016631.

From International summer school on crystallographic computing; Mulheim an der Ruhr, F.R. Germany (30 Jul 1984).

This paper describes two general ways in which computational models of crystals (phenylnapthalenes, diopside) can be used to extend the information available from experiments. The calculation of intramolecular potentials and the geometry of isolated molecules from observed crystal structures provides knowledge which is presently unavailable from other sources. The extrapolation of crystal structures and properties to high pressures should provide a guide for experiments which are only just beginning to be undertaken.

46176 **(UCRL—90276-Rev.1) Online directory of databases for material properties.** Hampel, V.E.; Bollinger, W.A.; Gaynor, C.A.; Oldani, J.J. (Lawrence Livermore National Lab., CA (USA)). May 1984. Contract W-7405-ENG-48. 124p. (CONF-8406139—1-Rev.1). NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84016511.

From 9. international CODATA conference; Jerusalem, Israel (24 Jun 1984).

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This directory is intended to provide interactive access to scientific and technical databases available to the public that contain information pertaining to nuclear, atomic, molecular, physical, chemical, and mechanical properties of substances. In addition to the 101 data files previously reported, we have updated the information and identified more than 38 new numeric databases and predictive systems in these fields. We have included, where applicable, entries contained in the directories published by Cuadra Associates, CODATA, and UNESCO. In addition to describing the contents of the databases, we have provided updated information on the availability of the databases and their online access over public telephone and data networks. This directory is expected to become particularly important to the national and international magnetic- and laser-energy fusion projects, nuclear criticality safety, and computer aided engineering programs. Some of the numeric databases are directly accessible by authorized users via the TIS Intelligent Gateway Processor at LLNL (TIS/IGP), with self-guiding procedures for the downloading, merging, post-processing, and graphical/statistical analysis of data.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 36010045307, 45311, 45345, 45549, 45626, 45682, 45972, 45973, 46113, 46309, 46426, 46428, 47044, 47116

46177 (AECL—6841) Effect of saddle-point anisotropy on point-defect drift-diffusion into straight dislocations. Skinner, B.C.; Woo, C.H. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Feb 1983. 53p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84702912.

Effects on point-defect drift-diffusion in the strain fields of edge or screw dislocations, due to the anisotropy of the point defect in its saddle-point configuration, are investigated. Expressions for sink strength and bias that include the saddle-point shape effect are derived, both in the absence and presence of an externally applied stress. These are found to depend on intrinsic parameters such as the relaxation volume and the saddle-point shape of the point defects, and extrinsic parameters such as temperature and the magnitude and direction of the externally applied stress with respect to the line direction and Burgers vector direction of the dislocation. The theory is applied to fcc copper and bcc iron. It is found that screw dislocations are biased sinks and that the stress-induced bias differential for the edge dislocations depends much more on the line direction than the Burgers vector direction. Comparison with the stress-induced bias differential due to the usual SIPA effect is made. It is found that the present effect causes a bias differential that is more than an order of magnitude larger.

46178 (AECL—7989) Toughness improvement of AISI 403 12α chromium steels by double austenitizing heat treatments. Hosbons, R.R.; Ipohorski, M. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Feb 1983. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702908.

A heat treatment has been developed to increase the toughness of 12α Cr steels without lowering the yield strength. The heat treatment consists of austenitizing for 1 h at 1300 K, oil quench, austenitizing for 1 h at 1150 K, oil quench and temper for 8 h at 900 K with an air cool. Optical and scanning electron microscopy showed that failure mode changed from grain boundary fracture to quasi-cleavage. Transmission electron microscopy showed that the morphology and distribution of the carbides were changed from small lamellar-type carbides which gave low energy failures to large rounded carbides at the prior austenitic grain boundaries which gave high energy failures.

46179 (BNL—35131) Electron-irradiation effects in metals. Snead, C.L. Jr. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 9p. (CONF-841055—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016989.

From 16. national SAMPE technical conference on materials and processes; Albuquerque, NM, USA (9 Oct 1984).

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The study of Frenkel defects in metals is best accomplished using low-temperature electron damage as the means of producing well-characterized concentrations of defects. Subsequent experimental investigation of the damage using a variety of techniques is discussed. The strengths and the complementary nature of several of these techniques are highlighted by a report on work done using resistivity and internal friction measurements of a Nb_3Sn thin film irradiated below 20 K. Results are presented and some tentative conclusions drawn on the possible migration scenarios for the complexity of Nb and Sn interstitials and vacancies produced.

46180 (CONF-840848—6) Experimental determination of the critical cavity radius in Fe-10% Cr for ion irradiation. Horton, L.L. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 2p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016570.

From 42. annual Electron Microscopy Society of America meeting; Detroit, MI, USA (13 Aug 1984).

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The value for the critical radius depends on a number of experimental parameters, including the material, dose rate, microstructure, irradiation temperature and gas accumulation. In this investigation, transmission electron microscopy was used to obtain a value for the critical radius for ion bombardments of the ferritic alloy Fe-10% Cr. Microstructural examinations were performed with JEM 120 and JEM 120 CX transmission electron microscopes (TEM).

46181 (CONF-840892—1) Inclined dislocation emission at a shielded crack tip. Chang, S.J.; Ohr, S.M. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016703.

From Yamada conference on dislocations in solids; Tokyo, Japan (27 Aug 1984).

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Dislocation pileup along an inclined direction from a crack tip has been observed in metals during tensile deformation in an electron microscope. Dislocations are emitted from the crack tip, move through a dislocation-free zone and pileup in the plastic zone. The problem of inclined pileup of screw dislocations at a crack tip with a dislocation free zone has been solved by applying the Wiener-Hopf method. The maximum value of K cos (psi/2), the inclined stress intensity, is used to discuss the most preferred direction of dislocation emission. The result is used to discuss the crack tip blunting versus brittle extension. It is also shown that the resistance constant K/sub g/ of dislocation emission for the material can be determined by measuring the size of the dislocation free zone.

46182 (CONF-8409107—5) Study of the mechanism for annealing embrittlement of an iron-based metallic glass. Kroeger, D.M.; Koch, C.C.; McKamey, C.G.; Scarbrough, J.O.; Padgett, R.A. (Oak Ridge National Lab., TN (USA); North Carolina State Univ., Raleigh (USA). Dept. of Materials Engineering). 1984. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016856.

From 5. international conference on rapidly-quenced metals; Wurzburg, F.R. Germany (3 Sep 1984).

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Fracture surfaces of annealed and embrittled $Fe_{80}B_{16}Si_3C_2$ melt-spun ribbons were examined by Auger electron spectroscopy. Evidence was found that inhomogeneous distributions of oxygen and of alloy constituents may be involved in embrittlement. It was found that microadditions of cerium to the alloy decreased the rate of embrittlement.

46183 (DOE/ER/10870—149) Early stage of crystallization of (Zr/sub 1-x/Hf/sub x/)$_{62}$Ni$_{38}$ metallic glasses. Schulz, R.; Matijasevic, V.; Johnson, W.L. (California Inst. of Tech., Pasadena (USA). W.M. Keck Lab. of Environmental Engineering Science). May 1984. Contract AT03-81ER10870. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017280.

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This paper reports a directly observable correlation between the chemical short range order and the electrical resistivity in me-

tallic glasses. The phase transition corresponding to the first exotherm observed in a DSC scan on (Zr/sub 1-x/Hf/sub x/)$_{62}$Ni$_{38}$ is peculiar in a sense that, contrary to usual metallic glasses, this transition is associated with an increase in electrical resistivity and x-ray diffraction taken just after the DSC peak shows only the broad diffuse band characteristic of the glassy phase. Electrical resistivity, differential scanning calorimetry, low temperature superconducting measurements, high angle x-ray diffraction, transmission electron microscopy and Moessbauer spectroscopy are used to study this transition in detail.

46184 **(DOE/ER/10870—150) Electrical resistivity and structural changes upon relaxation and crystallization of (Mo/sub 0.6/Ru/sub 0.4/)sub 100-x/B/sub x/ metallic glasses.** Schulz, R.; Mehra, M.; Johnson, W.L. (California Inst. of Tech., Pasadena (USA). W.M. Keck Lab. of Engineering Materials). Jun 1984. Contract AT03-81ER10870. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017281.

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Crystalliztion of (Mo/sub 0.6/Ru/sub 0.4/)/sub 100-x/B/sub x/ glasses takes place in three steps. The first step, corresponds to the precipitation of the sigma phase Mo_5Ru_3 which decomposes at higher temperatures. The second step is associated with the formation of an hcp solid solution of Mo in Ru, and in the last step the remaining amorphous matrix crystallize in an fcc boride. Detailed electrical resistivity measurements taken below the crystallization temperature reveal an excess resistivity above the usual linear temperature dependence predicted by the Ziman theory. The increase in resistivity is associated with the onset of long range compositional inhomogeneity (spinodal decomposition) and the decrease with the beginning of crystallization. The electrical behavior for samples pre-annealed for 12 hours at various temperatures suggest that boron migration is partly responsible for this excess resistivity. The linear relationship between the conductivity and the electronic density of states across the concentration range, and the fact that upon annealing (Mo/sub 0.6/Ru/sub 0.4/)$_{82}$B$_{18}$ the maximum in the excess resistivity is associated with a minimum in the density of states, indicates that Mott's model is not applicable and suggests that the d electrons are important in the conduction. The changes in the radial distribution function during annealing at 525°C are also reported.

46185 **(DOE/ET/26214—T2) Evaluation of laser welding techniques for hydrogen transmission. Progress report, 1 September 1979-30 September 1979.** Mucci, J. (Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Government Products Div.). 19 Oct 1979. Contract AC02-77ET26214. 5p. (COO—4355-9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017653.

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Machining of the seventeen welded low-cycle fatigue specimens required for testing is reported. The A106B carbon steel specimens for all welded conditions (GTAW, EBW, and LBW) were completed and testing was initiated. (LEW)

46186 **(DOE/ET/26214—T3) Evaluation of laser welding techniques for hydrogen transmission. Monthly progress report No. 8, May 1-31, 1978.** Mucci, J. (Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Government Products Div.). 20 Jun 1978. Contract AC02-77ET26214. 13p. (COO—4355-8). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017302.

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As the eighth progress report for this contract, the continuation of welded material mechanical properties tests are discussed.

46187 **(DOE/OR/21400—T41) Ion beam and laser induced surface modifications.** Appleton, B.R. (Oak Ridge National Lab., TN (USA)). Jan 1984. Contract AC05-84OR21400. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84016569.

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In this chapter the capabilities of energetic ion beam and laser processing of surfaces are reviewed. Ion implantation doping, ion beam mixing, and laser and electron beam processing techniques are capable of producing new and often unique surface properties. The inherent control of these techniques has led to significant advances in our ability to tailor the properties of solids for a wide range of technological applications. Equally important, these techniques have allowed tests of fundamental materials interactions under conditions not heretofore achievable and have resulted in increased understanding of a broad range of materials phenomena. These include new metastable phase formation, rapid nucleation and crystal growth kinetics, amorphous metals and metglasses, supersaturated solid solutions and substitutional alloys, interface interactions, solute trapping, laser-assisted chemical modifications, and a host of others. 169 references, 5 tables.

46188 **(ECN—152) Low dose irradiation effects on DIN 1.4948 mechanical properties.** Schaaf, B. van der; Vries, M.I. de. (SEE CODE- 4593600 Stichting Energieonderzoek Centrum Nederland, Petten). Mar 1984. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702913.

In a liquid metal fast breeder reactor large components such as dia grid, core shielding and reactor vessel must hold out the total plant life, since they cannot be replaced economically. These permanent near core structures are exposed to low total neutron fluences up to 10^{25} n.m^{-2} in the temperature range of about 650 K to 850 K. There is no significant effect of irradiation on load-controlled high-cycle fatigue with frequencies of 1 Hz or higher. The results are discussed.

46189 **(EGG-M—06984) Low pressure boiling lithium experiments.** Wadkins, R.P. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 15p. (CONF-840816—20). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017237.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

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A series of low pressure boiling lithium tests have been run to determine wall superheat. These tests were run primarily to identify the possibility of using boiling lithium as a first wall coolant in fusion devices. One of the major disadvantages of using liquid metals in a magnetically contained fusion machine is the large pump energy expended to force the liquid metal through the magnetic field. The large heat of vaporization for lithium would allow removal of the energy generated in the plasma with an order of magnitude reduction in pump energy. This experimental work has determined that the wall superheat is lower than predicted by extrapolation of existing equations to low pressure (2.6 Pa, 20 millitorr). This experiment also determined that the heat flux from a presently conceived design of a fusion reactor is easily removed with boiling lithium.

46190 **(FEI—1338) Insulating coatings of aluminium- and beryllium oxides in thermocouple wire.** Fraktovnikova, A.A.; Maslov, I.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702906.

Some recommendations on application of aluminium- and beryllium oxides as electrical insulating coatings for thermocouple wire are given in the paper. Problems of the coating compatibility with thermocouple wire of tungsten-rhenium alloys (WR-5, WR-20) at temperatures up to 1800 deg C are considered. Data on electrical insulating properties are presented for coatings heated in vacuum (approximately 10^{-3} Pa) up to temperatures of 1800 deg C.

46191 **(IFTM-CS—6-1982) Magnetic properties of rare-earth intermetallic compounds.** Burzo, E. (Institutul Central de Fizica, Bucharest (Romania)). Oct 1982. 86p. NTIS (US Sales Only), PC A05/MF A01. File Number DE84702909.

We give a brief survey of some representative data on crystal structure and magnetic behaviour of binary rare-earth transition metal compounds. We review then the magnetic interactions appearing in RMsub(x)(M = Fe or Co) compounds, as well as the models which seem to be appropriate in describing the magnetic behaviour of transition metals atoms. We compare the results of magnetic and EPR studies performed on Gd(Msub(y)Alsub(1-y))$_a$, Gd(Msub(y)Alsub(1-y))$_a$, (Gdsub(x)Ysub(1-x))M$_2$ and

(Gdsub(x)Ysub(1-x))M_3 with the predictions of the models. Next, we present the local environment model, the Fermi liquid model, the predictions of the coherent potential approximation as well as the influence of the distances between M atoms on their magnetic behaviour.

46192 (IRNE—151-1982) Researches on the static and dynamic structure of the liquid metals by neutron diffraction and inelastic neutron scattering. Padureanu, I.; Rapeanu, S.; Rotarescu, Gh.; Craciun, C. (Institutul Central de Fizica, Bucharest (Romania)). May 1982. 46p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702910.

The main results obtained in our laboratory in the field of the static and dynamic structure of the liquid metals are given in the paper. In the study of the various properties of the liquid metals we have to obtain higher accurate data about the static structure factor S(Q). From the experimental structure factor S(Q) one can derive the radial distribution function g(r), the direct correlation function c(r) and the pair interatomic potential phi(r). The experimental results concerning S(Q) obtained by means of the neutron diffraction technique are given for several liquid metals (Sn,Al,Ga,Bi). Detailed results of the g(r), c(r) and phi(r) calculations are also presented for each metal. Interesting information are obtained for liquid gallium which is supercooled to 0deg C and shows an anomalous behaviour in melting. Some contributions on the multiple scattering correction in the diffraction experiments on liquid metals are shown. Another point of view to study the liquid metals is in terms of the dynamic structure factor $S(Q,\omega)$ which includes whole dynamics of the system. The experimental $S(Q,\omega)$ obtained by inelastic neutron scattering on liquid Bi, Pb and Na as well as the theoretical models used for comparison one surveyed. It was also pointed out that the effect of the multiple scattering is very important. The multiple scattering calculations have been performed by means of the computing programme based on the Monte Carlo technique at CYBER 170-720 computer.

46193 (IRNE—153-1982) Thermophysical properties and some parameters of liquid sodium. Rapeanu, S.; Padureanu, I.; Rotarescu, G.; Craciun, C.; Ion, M. (Institutul Central de Fizica, Bucharest (Romania)). Jul 1982. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702911.

In the paper are reported some results on the thermophysical properties of the liquid sodium obtained by means of the neutron scattering and of the theories existing for various physical parameters. The results are based on hard sphere approach and neutron diffraction experiments performed in the region of the small momentum transfer. From this measurement extrapolated at $Q \rightarrow 0$, the packing fraction eta as a function of temperature in the range 100-600 deg is obtained. Knowing the parameter eta, the structure factor S(Q) and the radial distribution function g(r) are calculated. To calculate various physical parameters of the liquid sodium like: electrical resistivity, thermoelectric power, viscosity coefficient, electrical conductivity etc., S(Q), g(r) and a Lennard Jones interaction potential phi(r) are used.

46194 (IS-M—513) Preparation of low-silicon vanadium metal. Carlson, O.N.; Schmidt, F.A. (Ames Lab., IA (USA)). 1984. Contract W-7405-ENG-82. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84014818.

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A modified method for preparing high purity vanadium metal by the aluminothermic reduction of V_2O_5 oxide in a water-cooled copper crucible is described. Experiments designed to prepare low-silicon vanadium directly from commercial grade V_2O_5 show promise of simplifying the process for producing this material on a commercial scale. A vanadium-oxygen alloy is first prepared and then double electron-beam melted into platelet form during which 810 is removed by volatilization. Residual oxygen is removed from the platelets by a calcium deoxidation procedure. Experiments in which V_2O_5 is added to commercial vanadium metal to lower its silicon content by similar processing are also described. Silicon in amounts up to 1000 wt ppM was found to have a rather small effect on the hardness, yield and tensile strength and ductility of vanadium.

46195 (IS-T—260) Single crystalline elastic constants of the $MgCu_2$-$MgZn_2$ system. Shannette, G.W. (Ames Lab., IA (USA)). Nov 1968. Contract W-7405-ENG-82. 49p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017126.

Thesis. Submitted to Iowa State Univ., Ames.

The adiabatic single crystalline elastic constants of six $Mg(Cu, Zn)_2$ cubic Laves phases have been determined by the ultrasonic pulse-echo technique over the compositional range 10 to 50 mol % $MgZn_2$ and over the temperature range 4.2 to 300°K. In addition the elastic constants of the hexagonal $MgZn_2$ Laves phase were measured as a function of temperature. A minimum exists in the compositional dependence of the cubic $Mg(Cu, Zn)_2$ phase at 20 mol % $MgZn_2$ for all three directly measured values and the anisotropy ratio shows a maximum at the same composition. These phenomena may be related to the fact that their Fermi surface touches the [311] faces of the Brillouin zones at this composition. The various energy contributions to the elastic shear constants were considered and it was concluded that the Fermi energy has to be included to achieve satisfactory agreement between the calculated and measured elastic constants. The Debye temperatures were calculated and were found to decrease at low zinc contents and then increase at compositions above 20 mol % $MgZn_2$ for the cubic $Mg(Cu, Zn)_2$ phase. The initial decrease is probably due to the substitution of the heavier zinc atoms for the copper atoms and the increase above 20 % $MgZn_2$ is probably due to an increase in the interatomic force constants.

46196 (KFTI—82-47) Mechanical properties and microstructure of welded joints of Eh-125 alloy (Zr-2.5%Nb) in the 20 to 650 deg C range following programmed hardening. Gindin, I.A.; Chirkina, L.A.; Malik, G.N.; Khinkis, B.A.; Danilov, P.A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702907.

The effect is studied of programmed loading, at a speed of 0.6 kg/mm²xh up to σsub(max)=13 kg/mm² at 350 deg C, on the mechanical properties and resistance to grain growth in the near-joint zone of welded joints of the Eh125 alloy. It is shown that programmed loading of Eh125 alloy samples with welded joints causes a 17% growth of strength characteristics with a simultaneous 20% increase in the plasticity safety margin. It is noted that programmed loading results in a decrease of the grain size in the zone of welded joints, increase of the joint zone, containing martensite α'-phase, and the appearance of fine structure inside the acicular structure of α'-phase. When comparing the program-loaded and conventionally processed samples of Eh125 alloy welded joints it is established that the greater grain size stability during heatings of welded joints up to 650 deg C is observed in samples treated in the regime of programmed hardening.

46197 (KU-HCOE-FL2-R—83-16) New high-pressure phase and the equation of state of YbH_3. Olsen, J.S.; Buras, B.; Steenstrup, S.; Gerward, L.; Lebech, B.; Skriver, H.L.; Johansson, B. (Copenhagen Univ. (Denmark). H.C. Oersted Inst.). 1983. 29p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702914.

High-pressure X-ray diffraction studies have been performed on YbH_3 up to 28 GPa. A first order phase transition from an orthorhombic structure to a collapsed hexagonal structure with $c/a = 1.34$ has been observed at about 15 GPa. The transition is accompanied by a 5.2% decrease in volume. Fitting the V(P) data to Murnaghan's equation of state yields the bulk modulus $B_0 = 40.2$ GPa and its pressure derivative $B_0' = 4.75$ for the orthorhombic phase. For the hexagonal phase the bulk modulus is found to be $B = B_0 = 138$ GPa independent of pressure, i.e. $B_0' = 0$.

46198 (LBL—18051) Elastodynamic stress intensity factors of an interface finite-width crack. Yang, H.J.P.; Bogy, D.B. (Lawrence Berkeley Lab., CA (USA)). Jul 1984. Contract AC03-76SF00098. 16p. (CONF-840738—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016908.

From Progress in quantitative NDE; San Diego, CA, USA (8 Jul 1984).

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Many applications in industry utilize a layered elastic structure in which a relatively thin layer of one material is bonded to a

much thicker substrate. Often the fabrication process is imperfect and cracks occur at the interface. This paper is concerned with the plane strain, time-harmonic problem of a single elastic layer of one material on a half space of a different material with a single crack at the interface. The derivation of the required Green's functions for dilational and rotational point sources in the uncracked layered half space are outlined here. These functions are used with the appropriate form of Green's integral theorem to derive the scattered field potentials for arbitrary incident fields in the cracked layered half space. These potentials are then used in turn to reduce the problem to a system of singular integral equations for determining the gradients of the crack opening displacements in the scattered field. The integral equations are analyzed to determine the crack tip singularity, which is found, in general, to be oscillatory, as it is in the corresponding static problem of an interface crack. For many material combinations of interest, however, the crack tip singularity in the stress field is one-half power, as in the case of a homogeneous material. In the numerical work of this work attention is restricted to this class of composites and the integral equations are solved numerically to determine the Mode I and Mode II stress intensity factors as a function of a dimensionless wave number for various ratios of crack length to layer depth. The results are presented in graphical form and are compared with previously published analyses.

46199 **(LBL—18136) Electronic bandstructure of an incommensurate crystal.** Rasing, T. (Lawrence Berkeley Lab., CA (USA)). Jun 1984. Contract AC03-76SF00098. 6p. (CONF-840879—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016891.

From 17. international conference on the physics of semiconductors; San Francisco, CA, USA (6 Aug 1984).

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The consequences of an incommensurate lattice modulation on the electronic energy levels have been studied by optical transmission experiments on Rb_2ZnBr_4. The results are analyzed with a simple tight-binding model in which the superspace symmetry of the crystal is taken into account. The lattice translational symmetry of crystalline matter leads to the well known concepts of the Brillouin zones, Bloch electrons, phonons and the like. In a crystal where the lattice is periodically distorted with a period that is incommensurate with the underlying lattice, this translational symmetry is broken. Nonetheless, incommensurate crystals are perfectly ordered and can be described by higher dimensional so-called superspace groups. In this paper we will show how this superspace approach provides a natural framework to understand their electronic bandstructure as well. 5 references, 3 figures.

46200 **(LBL—18209) Electronic and magnetic properties of transition-metal surfaces, interfaces and overlayers.** Falicov, L.M.; Victora, R.H.; Tersoff, J. (Lawrence Berkeley Lab., CA (USA); International Business Machines Corp., Yorktown Heights, NY (USA). Thomas J. Watson Research Center). Aug 1984. Contract AC03-76SF00098. 16p. (CONF-840821—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016886.

From 1. international conference on the structure of surfaces (ICSOS); Berkeley, CA, USA (13 Aug 1984).

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Results of calculations for the electronic and magnetic properties of transition-metal surfaces, interfaces and overlayers are presented for a variety of systems. They involve Ni, Co, Fe and Cr in a diversity of forms, including alloys, metastable configurations, and overlayers on nonmagnetic metals. The overall behavior of these systems can be interpreted in terms of four qualitative rules which are presented, analyzed, and illustrated.

46201 **(LBL—18236) Surface structure determination with ARPEFS.** Barton, J.J.; Robey, S.W.; Bahr, C.C.; Shirley, D.A. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 10p. (CONF-840821—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016904.

From 1. international conference on the structure of surfaces (ICSOS); Berkeley, CA, USA (13 Aug 1984).

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We describe a method of surface structure determination based on oscillations in core-level photoemission intensity - Angle-Resolved Photoemission Extended Fine Structure - with particular emphasis on the use of Fourier transformation. Qualitative comparisons of Fourier power spectra reveal adsorption sites and shortcomings in theoretical calculations; quantitative backtransformation analysis allows accurate bond lengths and bond angles to be determined. Examples are drawn from these similar atomic adsorption systems: c(2x2)S/Ni(100), p(2x2)S/Cu(100) and c(2x2)S/Ni(110).

46202 **(ORNL/TM—9172) Fracture toughness of austenitic stainless steel weld metal at 4 K.** Goodwin, G.M. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84016638.

Selection of the welding processess and weld filler metals for fabrication of a large toroidal superconducting magnet is described. Data available in the literature are collected and compared with data generated in this study for three welding processes, shielded metal arc (SMA), gas tungsten arc (GTA), and flux cored arc (FCA) welds had the highest fracture toughness as measured by K/sub Ic/ estimated from J/sub Ic/. The SMA and FCA welds had about the same toughness, below the GTA values but above the average from the literature. The fracture mode for all three processes was typified by ductile dimples. The fracture morphology of the FCA weld specimens was influenced by the solidification substructure, and small particles were found to be nucleation sites for void formation, especially for the GTA welds. All three welding processes were deemed adequate for the intended service and were used to fabricate the large magnet. A trunnion-type turning fixture eliminated the need for welding in the vertical and overhead positions. The GTA process was used for all root passes, and the horizontal welds were filled by the SMA process. Over 80% of the welds were done in the flat position with the FCA process, and its high deposition rate and ease of operation are credited with contributing greatly to the success of the effort.

46203 **(SAND—84-1708C) Interaction of hydrogen with defects in metals.** Besenbacher, F.; Myers, S.M.; Noerskov, J.K. (Aarhus Univ. (Denmark). Inst. of Physics; Sandia National Labs., Albuquerque, NM (USA); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). 1984. Contract AC04-76DP00789. 39p. (CONF-840760—11). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016781.

From Ion beam modification of materials conference; Ithaca, NY, USA (16 Jul 1984).

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The interaction of hydrogen with defects in metals is reviewed, with the major emphasis on ion-implantation studies. Experimental results for trap binding enthalpies of hydrogen to defects (such as vacancies, interstitials, dislocations, and bubbles/voids) are discussed, as is the lattice location of hydrogen trapped to these defects (mainly vacancies) obtained by the channeling technique. The experimental results are compared with theoretical predictions based on the effective-medium theory. It will be shown how an interplay between theory and experiment has recently enhanced our understanding of these hydrogen-defect interactions. 57 references, 11 figures.

46204 **(SU-DMS—84-R-3) Modelling of deformation and fracture in high-temperature structural materials. Final report, February 1, 1983-June 30, 1984.** Miller, A.K. (Stanford Univ., CA (USA). Dept. of Materials Science and Engineering). 1984. Contract AT03-76ER70057. 122p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84016906.

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Objective is to develop quantitative models which can predict fracture of metals and alloys. Particular emphasis is placed on materials-limited aspects of energy technology which, in turn, leads to an emphasis on predicting fracture of high-temperature structural materials and fracture under complex histories and environments. The models developed in this project can be used either directly by high-temperature structural design analysts for life prediction of specific components, or indirectly to guide the development of design rules, codes, etc.

46205 Effects of ion-implanted C on the microstructure and surface mechanical properties of Fe alloys implanted with Ti. Follstaedt, D.M.; Knapp, J.A.; Pope, L.E.; Yost, F.G.; Picraux, S.T. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **45**: No. 5, 529-531(1 Sep 1984). Contract AC04-76DP00789.

The microstructural and tribological effects of ion implanting C into Ti-implanted, Fe-based alloys are examined and compared to the influence of C introduced by vacuum carburization during Ti implantation alone. The amorphous surface alloy formed by Ti implantation of pure Fe increases in thickness when additional C is implanted at depths containing Ti but beyond the range of carburization. Pin-on-disc tests of 15-5 PH stainless steel show that implantation of both Ti and C reduces friction significantly under conditions where no reduction is obtained by Ti implantation alone; wear depths are also less when C is implanted. All available experimental results can be accounted for by consideration of the thickness and Ti concentration of the amorphous Fe-Ti-C alloy. The thicker amorphous layer on samples implanted with additional C extends tribological benefits to more severe wear regimes.

46206 Some observations on heavy fermion superconductivity in UBe_{13}. Stewart, G.R.; Giorgi, A.L. (Los Alamos National Laboratory, Los Alamos, New Mexico). *Journal of Low Temperature Physics;* **56**: No. 3, 379-381(1 Aug 1984).

Recently it has been discovered that very slight substitution of Cu for Be in UBe_{13} depresses superconductivity below 0.050 K. We have measured the low-temperature specific heat of UBe/sub 12.94/ Cu/sub 0.06/ (T/sub c/ <0.050 K) and found that the heavy fermion, condensed phase present in UBe_{13} appears unaltered in the copper-substituted material. Therefore, the presence of high-mass electrons is not directly correlated superconductivity in UBe_{13}.

46207 Diffuse x-ray scattering studies of defect reactions in electron-irradiated dilute nickel alloys. 1. Ni-Si. Averback, R.S.; Ehrhart, P. (Argonne National Lab., IL). *Journal of Physics F: Metal Physics;* **14**: No. 6, 1347-1363(Jun 1984).

Huang diffuse scattering was employed to study defect properties in dilute Ni-Si alloys. Ni alloys containing 1 at.% and 0.05 at.% Si were irradiated with electrons at 4.2 K and were subsequently isochronally annealed. It was found that, prior to annealing, the Frenkel-pair resistivities and self-interstitial atom configurations were the same in the alloys as in pure Ni. The independence of the Frenkel-pair resistivity to Si concentration indicates that the resistivities arising from Frenkel pairs and Si solute are linearly additive in Ni. After annealing through stage I to 85 K, the defect cluster size grew to 1.5, 2.3 and 3.0 interstitial atoms for the 1 at.% Si, 0.05 at.% Si and pure Ni specimens, respectively. These results demonstrate that self-interstitial atoms are not immobilised by single Si atoms in Ni, but rather complexes involving several Si atoms and/or two interstitial atoms are the stable defects at the end of annealing stage I. It was also observed that Si solute in Ni strongly suppresses the growth of interstitial clusters in stage II. In the 1 at.% Si alloys di-interstitials were immobilised up to temperatures between 200 and 300 K. There was no indication that Si solute reduced vacancy mobility in annealing stage III. The consequences of these results for the understanding of high-temperature radiation effects in alloys are discussed.

46208 Temperature- and pressure-induced crystal phase transitions in Be. Lam, P.K.; Chou, M.Y.; Cohen, M.L. (California Univ., Berkeley (USA). Dept. of Physics; Lawrence Berkeley Lab., CA (USA)). *Journal of Physics C: Solid State Physics;* **17**: No. 12, 2065-2073(30 Apr 1984).

Beryllium is known to undergo a HCP-BCC transition at about 1530 K and ambient pressure. This transition is studied theoretically by comparing the Gibbs free energies for the HCP, FCC and BCC modifications of Be. The static lattice energy is calculated using the ab initio pseudopotential method. The phonon energy and entropy are estimated from the calculated elastic constants. A mechanism for this transition is proposed based on the results of our calculations. At high temperature, the BCC modifications is found to be stabilised by the large entropy for this phase caused by the presence of soft phonon modes. Possible pressure-induced phase transitions are examined. It was found that at about 1-2 Mbar the FCC and BCC phases are both more stable than the HCP phase. The regions of FCC and BCC stability lie too close to be separated in the present calculation.

46209 Chlorination of cobalt in an argon-1 pct oxygen-1 pct chlorine mixture at 1000 K. McNallan, M.J.; Kang, C.T.; Liang, W.W. (Dept. of Materials Eng. at the Univ. of Illinois at Chicago, Chicago, IL). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **15A**: No. 2, 403-405(Feb 1984).

The corrosion in a gas mixture containing 1 pct oxygen and 1 pct chlorine in argon has been investigated at 1000 K. The rate of corrosion is controlled by transport of $CoCl_2(g)$ in the gas phase, with the effective vapor pressure of $CoCl_2(g)$ at the gas-solid interface being controlled by the reaction between $Co_3O_4(s)$ and the gas when the performed scale is more than 1.5×10^{-3} cm thick. When the scale is thin, the corrosion rate is higher and may approach the maximum theoretical rate for volatilization of solid $CoCl_2(s)$.

46210 Contribution to the theory of positive muon diffusion in metals at low temperature. Yaouanc, A. (Los Alamos National Lab., NM (USA)). *Hyperfine Interactions;* **17**: No. 1-4, 131-132(Jan 1984). (CONF-830455—).

From Yamada conference on muon spin rotation and associated problems; Shimoda, Japan (18 Apr 1983).

The author studies the temperature dependence of the μ^+ diffusion in a metal within the small polaron theory. The geometry of the strain field due to an impurity is shown to strongly influence the μ^+ diffusion properties. Part of the Al data is reanalyzed.

46211 Computational methods for fracture mechanics analysis of pressurized-thermal-shock experiments. Bass, B.R.; Bryan, R.H.; Bryson, J.W.; Merkle, J.G. (Oak Ridge National Lab., TN (USA)). pp 533-546 of Proceedings of the third international conference on numerical methods in fracture mechanics, held at University College, Swansea, 26th-30th March 1984. Luxmore, A.R.; Owen, D.R.J. (University Coll. of Swansea (UK). Dept. of Civil Engineering) (eds.). Swansea, England; Pineridge Press (1984). (CONF-8403103—).

From 3. international conference on numerical methods in fracture mechanics; Swansea, Wales, UK (26 Mar 1984).

Extensive computational analyses are required to determine material parameters and optimum pressure-temperature transients compatible with proposed pressurized-thermal-shock (PTS) test scenarios and with the capabilities of the PTS test facility at the Oak Ridge National Laboratory (ORNL). Computational economy has led to the application of techniques suitable for parametric studies involving the analysis of a large number of transients. These techniques, which include analysis capability for two- and three-dimensional (2-D and 3-D) superposition, inelastic ligament stability, and upper-shelf arrest, have been incorporated into the OCA/ USA computer program. Features of the OCA/USA program are discussed, including applications to the PTS test configuration.

46212 Effect of hydrogen on the multiaxial stress-strain behavior of titanium tubing. Lentz, C.W.; Koss, D.A.; Stout, M.G. (Western Electric Co., Reading, PA). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **14A**: 2527-2533(Dec 1983).

The influence of internal hydrogen on the multiaxial stress-strain behavior of commercially pure titanium has been studied. Thin-walled tubing specimens containing either 20 or 1070 ppm hydrogen have been tested at constant stress ratios in combined tension and internal pressure. The addition of hydrogen lowers the yield strength for all loading paths but has no significant effect on the strain hardening behavior at strains greater than or equal to 0.02. Thus, the hydrogen embrittlement of titanium under plain strain or equibiaxial loading is not a consequence of changes of flow behavior. The yielding behavior of this anisotropic material is described well by Hill's (1950) quadratic yield criterion. As measured mechanically and by pole figure analysis, the plastic anisotropy changes with deformation in a manner which depends on stress state. Hill's criterion and the associated flow rule do not describe the multiaxial flow behavior well because of their inability to account for changes of texture which depend on multiaxial stress

path. Hence a strain dependent, texture-induced strengthening effect in equibiaxial tension is observed, this effect having the form of an enhanced strain-hardening rate. 21 references.

46213 **Vapor transport and DIGM in the Ni-Fe system.** Parthasarathy, T.A.; Shewmon, P.G. (Dept. of Metallurgical Eng., The Ohio State Univ., Columbus, OH). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **14A**: No. 12, 2560-2563(Dec 1983).

It has been realized dor over 30 years that at temperatures of less than roughly two-thirds the absolute melting temperature, diffusion down grain boundaries and dislocations plays a dominant role in determining the rate of interdiffusion in alloys. It now appears that the diffusion induced motion of existing grain boundaries (DIGM) and the nucleation of new grains, and the diffusion induced motion of these new boundaries, may often be the dominant mixing process in many systems. That is, it is the sweeping of the high diffusivity boundaries through the lattice that provides the solute penetration instead of diffusion down stationary boundaries and from there through the lattice, as has been assumed in all attempts to quantitatively describe the kinetics of grain boundary diffusion processes. The purpose of this note reports the rapid transport of iron into pure Ni at 550 °C when the two samples are not in physical contact but both occupy a vycor tube evacuated before sealing. The novelty arises not only from the mode of vapor transport of iron, but from the copious nucleation of new grains on the surface as well as the active role of DIGM in the penetration of Fe into Ni.

46214 **The effect of hydrogen on the multiaxial stress-strain behavior of titanium tubing.** Lentz, C.W.; Hecker, S.S.; Koss, D.A.; Stout, M.G. (Michigan Technological University, Houghton, MI). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **14A**: No. 12, 2527-2534(Dec 1983).

The influence of internal hydrogen on the multiaxial stress-strain behavior of commercially pure titanium has been studied. Thin-walled specimens containing either 20 or 1070 ppm hydrogen were tested at constant stress ratios in combined tension and internal pressure. Hydrogen lowers the yield strength but has no significant effect on strain hardening behavior at strains $\epsilon \geq 0.02$. Thus, hydrogen embrittlement under plain strain or equibiaxial loading is not a consequence of changes of flow behavior. The yielding behavior is described well by Hill's quadratic yield criterion. As measured mechanically and pole figure analysis, the plastic anisotropy changes with deformation in a manner which depends on stress state. A strain dependent, texture-induced strengthening effect in equibiaxial tension an enhanced strain hardening rate.

46215 **Phase equilibria and kinetics in the solid state reaction between silicon and NiCrAl.** Hall, E.L.; Jackson, M.R.; Mehan, R.L. (General Electric Corporate Research and Development Center, Schenectady, NY). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **14A**: No. 8, 1549-1560(Aug 1983).

The result of the solid state reaction of silicon with a superalloy consisting of 70 at. pct Ni, 20 at. pct Cr, and 10 at. pct Al at 900 °C examined using light microscopy, electron microprobe analysis, and analytical electron microscopy. The crystallography and chemistry of the phases present in zones was determined. The reaction paths are described with reference to binary and ternary phase equilibrium diagrams. The nature and extent of the reaction are compared with previous experiments in which silicon carbide and reaction-bonded Si-SiC were reacted with the model superalloy.

46216 **A study of a cellular phase transformation in the ternary Ni-Al-Mo alloy system.** Kaufman, M.J.; Eades, J.A.; Fraser, H.L.; Loretto, M.H. (Univ. of Illinois, Urbana, IL). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **14A**: No. 8, 1561-1572(Aug 1983).

Orthorhombic Ni_3Mo has been observed as a product of a cellular precipitation reaction occurring at grain boundaries in both Ni-12Al-15Mo and a ternary eutectic Ni-12.8Al-22.2Mo at. pct) when heat treated at intermediate temperatures (600 to 850°C). Since this phase is usually heavily faulted, the diffraction symmetries are reduced causing ambiguities in analysis. Therefore, a binary stoichiometric Ni_3Mo alloy was produced and heat treated in a manner designed to minimize faulting. Convergent beam patterns exhibited symmetries that identify it as having the mmm point group. Orthorhombic Ni_3Mo was also observed within the grains of the ternary eutectic alloy following prolonged aging treatments; the orientation relationship between the Ni_3Mo and the fcc matrix was determined to be identical with that in the cellularly transformed regions.

46217 **Further observations on the formation mechanisms of precipitate-free zones in an aged Al-16 wt pct Ag alloy.** Merchant, S.M.; Notis, M.R.; Williams, D.B. (Lehigh Univ., Bethlehem, PA). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **14A**: No. 8, 1745-1749(Aug 1983).

In summary solute diffusion effects can describe the presence of asymmetric solute concentration profiles and asymmetric PFZ around grain boundaries in an aged Al-16 wt pct Ag alloy. These effects are also responsible for the lack of precipitate (γ) coarsening and cause reprecipitation during the initial aging treatment.

46218 **Determination of Luders strains and flow properties in steels from hardness/microhardness tests.** Haggag, F.M.; Lucas, G.E. (EG & G Idaho, Inc., Idaho Falls, ID). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **14A**: No. 8, 1607-1615(Aug 1983).

Development of radiation tolerant materials for use in fusion reactors requires testing of small volumes of materials in high energy neutron irradiation facilities. As part of an effort to develop methods for extracting mechanical property information from small specimens, this study investigated techniques to characterize flow properties of steels exhibiting Luders strains from ball indentation tests. A quantitative relationship was found between the amount of pile-up formed during indentation and the magnitude of the Luders strain during tensile testing SAE 1015 steel equations correlated hardness data to the homogeneous true-stress-true-plastic strain relationship in the strain range 1 to 10 pct at room temperature.

46219 **Hydrogen pressure dependence of the fracture mode transition in nickel.** Jones, R.H.; Baer, D.R.; Bruemmer, S.M.; Thomas, M.T. (Battelle-Northwest Laboratory, Richland, WA). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **14A**: No. 8, 1729-1736(Aug 1983).

A relationship between fracture mode, grain boundary composition, and hydrogen pressure has been determined for nickel straining electrode samples tested at cathodic potentials. This relationship can be expressed as C /SUB s/ α P /SUP -n/ /SUB H2/ where C /SUB s/ is the critical grain boundary sulfur concentration corresponding to 50 pct transgranular and 50 pct intergranular fracture and P /SUB H2/ is the hydrogen pressure. The value of n was found to be between 0.34 and 0.9. This expression was derived by relating C /SUB s/ to th hydrogen overpotential with the Nernst equation. At a cathodic test potential of -0.3 V (SCE). C / SUB s/ was equal to 0.20 monolayers of sulfur and at higher cathodic potentials or higher hydrogen pressures, C /SUB s/ decreased such that at -0.72 V (SCE) C /SUB s/ was equal to 0.045 monolayers of sulfur. The inverse hydrogen pressure dependence observed with cathodic hydrogen is similar to that for the hydrogen permeation rate or a critical hydrogen concentration derived by Gerberich et al. for gaseous hydrogen. This similarity between gaseous and cathodic hydrogen suggests that grain boundary impurities contribute to the hydrogen embrittlement process without altering the embrittlement process although this result does not indicate whether decohesion or plasticity dependent processes are responsible for the combined sulfur-hydrogen effect on the intergranular fracture of nickel.

46220 **Calculations of the binding of hydrogen to fixed interstitial impurities in nickel.** Daw, M.S.; Bisson, C.L.; Wilson, W.D. (Sandia National Laboratories, Livermore, CA). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **14A**: No. 7, 1257-1260(Jul 1983).

The authors calculated the binding energy of hydrogen to inert, fixed interstitial impurity atoms He, Ne, Ar, Kr, and Xe and

the chemically active impurities C, O, and N using local density functional theory including lattice relaxation.

46221 Microstructural origin of the skeletal ferrite morphology of austenitic stainless steel welds. Brooks, J.A.; Thompson, A.W.; Williams, J.C. (Carnegie-Mellon Univ., Pittsburgh, PA). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **14A**: No. 7, 1271-1282(Jul 1983).

Scanning transmission electron microscopy was conducted on welds exhibiting a variety of skeletal or vermicular ferrite morphologies in addition to one lathy ferrite morphology. During cooling, a large fraction of the ferrite transforms to austenite leaving a variety of ferrite morphologies. Comparison of composition profiles and partitioning showed ferrite structures result from a diffusion controlled solid state transformation. However, the overall measured composition profiles are a result of partitioning during both solidification and subsequent transformation.

46222 Flow localization accompanying the intergranular fracture of Ni_3A1. Schulson, E.M.; Davidson, D.L.; Viens, D. (Thayer School of Eng., Darmouth College, Hanover, NH). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **14A**: No. 7, 1523-1524(Jul 1983).

The purpose of this note is to show that localized plastic flow accompanies intergranular fracture within the strongly ordered $L1_2$ aluminide Ni_3A1. The work is part of a larger study on the brittle-to-ductile transition of this material, and was carried out to answer the question: Is the plastic strain which accompanies the propagation of cracks along grain boundaries greater than that which occurs throughout the bulk of the aggregate? The question is a qualitative one and is answered here by utilizing the qualitative aspects of the selected area channeling pattern (SACP) technique in scanning electron microscopy.

46223 Microfracture model for hydrogen embrittlement of austenitic steels. Stoltz, R.E.; Moody, N.R.; Perra, M.W. (Sandia National Laboratories, Livermore, CA). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **14A**: No. 7, 1528-1531(Jul 1983).

In summary, a model based on a critical local stress for intergranular fracture predicts variations in the size of a partially cracked region at crack arrest threshold. A critical stress for fracture in 200 MPa hydrogen gas at 298 K of a about 2800 MPa is consistent with the data. Increases in grain size are predicted to raise the lower limiting threshold value for high strength alloys if grain boundary segregation effects are eliminated.

46224 Oxidation of carburized Hastelloy X. Gan, D. (Brookhaven National Laboratory, Upton, NY). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **14A**: No. 7, 1518-1521(Jul 1983).

In a high temperature gas-cooled reactor (HTGR), small quantities of impurities such as H_2, H_2O, CO, CO_2, and CH_4 are present in the helium coolant. Prolonged exposure to these impurities at high temperature can result in undesirable mechanical properties due to corrosion. Extensive research has been performed on many candidate alloys to study their properties in HTGR helium, and in addition to oxidation, it has been found that carburization is also a possible problem in HTGR. Carbon in the graphite core, carried out by carbon-containing impurities such as CO and CH_4, can deposit on and diffuse into metallic components and cause carburization. The purpose of this research was to study the effects of carburization on an accelerated test.

46225 Evaluation of back stress determination techniques in metals. Jones, W.B.; Rohde, R.W. (Sandia National Labs., Albuquerque, NM (USA)). pp 395-402 of Transactions of the 7. international conference on structural mechanics in reactor technology. Vol. L. Materials modelling and inelastic behavior of materials and structures. Amsterdam, Netherlands; North-Holland (1983). (CONF-830867—; CONF-830805—; EUR—8596-DE/EN/FR). Contract AC04-76DP00789.

From 7. international seminar on computational aspects of the finite element method; Chicago, IL, USA (29 Aug 1983).

The desire to develop unified creep-plasticity (UCP) models come from the necessity to design advanced nuclear reactor components for service under conditions which include combined creep and low cycle fatigue. These models should also be physically based since they would be used to extrapolate from laboratory data to predict long service lives. An approach to UCP modelling centers on the hypothesis that the inelastic strain rate is determined by a balance between the competing processes of work hardening and recovery. One class of UCP models is characterized by a power law relationship between strain rate and stress. A state variable common to these models characterizes the isotropic hardening and is allowed to evolve with history according to simultaneous work hardening and recovery. In order to treat behaviours unique to unloading or reverse loading conditions, several models also include a kinematic hardening variable which is also allowed to evolve according to a balance of work hardening and recovery. Such a treatment of inelastic deformation can mathematically treat a wide variety of behaviors. The measured response of 316SS and A800 indicates that the kinematic variable must, in steady state, be taken as a constant fraction (about 0.8) of the applied stress. This experimental result makes it impossible for the simple power law type expression to properly predict the commonly observed power law breakdown behavior in most metals and alloys. It is proposed that an expression for total inelastic strain rate involving the sum of two separate strain rate contributions is more appropriate. Acknowledging that separate expressions and separate mechanisms dominate low stress (engineering service) conditions and high stress (laboratory test) conditions requires that more emphasis be placed on long time, low stress laboratory testing.

46226 Plastic flow phenomenology of 304L stainless steel. Semiatin, S.L.; Holbrook, J.H. (Battelle's Columbus Laboratories, Columbus, OH). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **14A**: No. 8, 1681-1696(Aug 1981).

The isothermal plastic flow behavior of annealed 304L austenitic stainless steel in uniaxial compression and torsional modes of deformation has been established over a wide range of temperatures and strain rates. In uniaxial compression, it was found that high rates of strain hardening, which persist to large strains ($\geqq$0.7) at cold-working temperatures, are found only at small values of strain ($\leqq$0.2) at hot-working temperatures because of the influence of dynamic softening processes. The effect of deformation heating on flow behavior, which occurs primarily at high strain rates, was most significant at cold-working temperatures. Deformation heating was observed to result in flow stress maxima and flow softening. A method of estimating high-strain rate, isothermal-flow curves in such instances was derived. Shear stress-shear strain curves derived from torsion tests exhibited dependences on temperature and strain rate similar to those observed in compression data. In contrast to the compression curves, however, the shear stress-shear strain curves showed lower rates of strain-hardening at room temperature, 400 °C, 800 °C, and (for high strain rates) 1000 °C. It was shown that the choice of definition for calculating effective stress-strain from the torsion data could not be modified to bring the two types of data into coincidence. Only a structure-sensitive explanation could be invoked to explain the difference.

46227 Ion beam activation for materials analysis: Methods and application. Conlon, T.W. (AERE Harwell Lab., Oxon). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1816-1819(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

A number of ion beam methods for materials analysis have been developed using Harwell's high voltage accelerators and these are currently being exploited for applications 'in house' and in industry. Ion beam activation is a relatively new area which has exhibited exceptional growth over the last few years. Activation by ion beams to produce a single dominant radioisotope as a surface label (thin layer activation or TLA) is becoming a mature technology offering ever increasing sensitivity for surface loss measurement (currently better than 0.1 μm or 10^{-7} cm^3 depending on the method of measurement) and remote monitoring of inaccessible components during studies of wear/erosion/ corrosion/sputtering and the like.

With the increasingly established credibility of the method has come the realisation that: (i) more complex and even multiple activation profiles can be used to extract more information on the characteristics of the surface loss process, (ii) that an analogous method can be used even on radiation sensitive materials through the newly established indirect recoil implantation process. (iii) that there is scope for treatment of truly immovable objects through the implantation of fission fragments, (iv) there is vast potential in the area of activation analysis. The current state of development of these methods which greatly extend the scope of conventional TLA will be briefly reviewed. Current applications of these and TLA in industry are discussed.

46228 **(BNL-tr—1035) Behavior of tritium in zirconium and Zircaloy: absorption - diffusion - desorption. A literature survey.** Muenzel, H.; Greger, G.U. (Brookhaven National Lab., Upton, NY (USA); Technische Univ. Darmstadt (Germany, F.R.). Fachbereich Anorganische Chemie und Kernchemie). [1984]. Contract AC02-76CH00016. Translation of KfK 2677; PWA No. 48/78. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017208.

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The behavior of hydrogen in zirconium and Zircaloy is discussed with respect to absorption, diffusion and desorption using published experimental results. Absorption as well as desorption of hydrogen is affected significantly by the adhering oxide layer and possibly by the oxygen concentration in the metal. The absorption rates obtained differ depending on the pretreatment of the metal. There are at times also large deviations in the published diffusion coefficients, whereas the values for maximum solubility agree quite well. Impurities therefore seem to have a greater effect on the mobility of the hydrogen than on equilibrium states. 63 references, 15 figures.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 36020045500, 46110, 46110, 46190, 46260, 46289

46229 **(DOE/ER/10915—4) High temperature corrosion of ceramics. Final report.** Blachere, J.R.; Pettit, F.S. (Pittsburgh Univ., PA (USA). Dept. of Metallurgical and Materials Engineering). Jun 1984. Contract AC02-81ER10915. 96p. (SETEC-MME—85-002). NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017084.

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Materials under study were Al_2O_3, silicon nitride and silicon carbide with various microstructures and impurity levels, and a high-purity SiO_2 glass. The investigation emphasized the fundamental understanding of the high-temperature corrosion of these materials in various atmospheres related to gas turbine operations. This includes gaseous corrosion and corrosion in the presence of deposits stable at high temperatures in those atmospheres. The SO_3-SO_2-O_2 atmosphere was emphasized with the corresponding Na_2SO_4 deposit. No reaction was observed between high-purity silicon nitride or silicon carbide and SO_3-SO_2-O_2 mixture at 1000°C. No significant impurity concentration was found in the oxide layers formed at 1000°C. Sulfates formed with some impurities when they had been concentrated in the oxide layer during prior oxidation at 1400°C. With Na_2SO_4 deposits in SO_3-containing atmospheres, little hot corrosion was observed for the high purity Si_3N_4 and SiC. It was usually characterized by the formation of cristobalite globules under the salt. In general, the Na_2SO_4 deposits tend to bring the impurity effects, observed in oxidation experiments, down to lower temperatures. SiO_2 and Al_2O_3 are very resistant to gaseous corrosion, in SO_3-containing atmospheres. Results on their hot corrosion at 1000°C indicates the susceptibility of silica to basic conditions developed with Na_2SO_4 deposits in oxygen atmosphere in agreement with those observed for SiC and Si_3N_4. The impure aluminas exhibited the same tendency because they contain silicate impurities. Calcium-containing impurities promote the formation of sulfates with other elements such as Mg and Al.

46230 **(GEPP-TIS—833) Effect of doping on the voltage holdoff performance of alumina insulators in vacuum.** Miller, H.C. (General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.). 21 Sep 1984. Contract AC04-76DP00656. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017163.

Alumina ceramics doped with various combinations of Cr, Mn, and Ti were fabricated into hollow cylindrical insulators, then assembled into vacuum diodes and tested with 25-μs voltage pulses. Four doped alumina ceramics with total dopant levels of 2.6 to 4.7 wt % and partial Cr plus Ti dopant levels of 1.0 to 2.4% performed very well. They had voltage holdoffs significantly better (25 to 40%) than plain alumina ceramics. Ceramics with total dopant levels of 5.3 to 5.6 percent performed only slightly better than plain alumina. Ceramics with partial Cr plus Ti dopant levels of 3.8 to 4.0% had significantly improved voltage holdoff capabilities, but undesirably high permanent failure rates (19 to 33%). Ceramics with total dopant levels greater than 7% performed very poorly, nearly all suffered permanent damage from breakdowns. These results suggest that desirable upper limits for doping are 5% for total dopants and 3% for Cr and Ti combined. Thus, doping a 94% Al_2O_3 alumina ceramic with appropriate amounts of Cr, Mn, and Ti can significantly improve the voltage holdoff capability of insulators fabricated from such ceramics. These doped ceramic insulators are suitable for use in ultrahigh vacuum applications.

46231 **(LA-UR—84-2492) Studies of ignition and combustion wave propagation in exothermic systems using high-speed photography.** Melton, G.F.; Behrens, R.G. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 7p. (CONF-840872—21). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016482.

From SPIE annual technical symposium; San Diego, CA, USA (19 Aug 1984).

High-speed photography is a useful diagnostic tool for studying the propagation of adiabatic combustion waves in highly exothermic solid state chemical systems. Temperatures on the order of 1500 to 4000°C can be achieved within the combustion wave front as it traverses the solid chemical reactants. Wave front propagation rates in such systems are typically 0.5 to 10 cm/s. High-speed photography (framing speeds of 400 to 2000 frames/s) is being used in our laboratory to study the structure of the combustion wave, obtain quantitative combustion wave propagation rates, and to study the details of ignition of the combustion wave using 150 watt HF/DF laser radiation. This paper presents examples of photographic experiments as well as examples of the chemical and physical information obtainable from these experiments.

46232 **(MIT—3773-43) Basic research in crystalline and noncrystalline ceramic systems. Annual report.** Kingery, W.D.; Coble, R.L. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Metallurgy and Materials Science). Apr 1968. 21p. NTIS, PC A02; 3; GPO Dep. File Number DE84016872.

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Various research subjects on ceramics have been investigated, including heat conduction, surface characteristics, diffusion in oxides, high-temperature kinetic processes, microstructure development, effects of microstructure on properties, structure and properties of noncrystalline ceramics, dissolution kinetics, and solid-vapor reactions. (DLC)

46233 **(MLM—3183(OP)) Oxygen diffusion from anodic surface oxide films on titanium subhydride studied by auger electron spectroscopy and electron energy loss spectroscopy.** Wang, P.S.; Wittberg, T.N.; Wolf, J.D.; Keil, R.G. (Monsanto Research Corp., Miamisburg, OH (USA). Mound; Dayton Univ., OH (USA)). 1984. Contract AC04-76DP00053. 15p. (CONF-840867—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016942.

From 9. international protechnics seminar; Colorado Springs, CO, USA (6 Aug 1984).

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In the present study, TiH/sub x/ ($0.5 < x < 1.7$) samples were prepared from titanium foil in order to study the diffusion of

oxygen in the titanium subhydride. An anodic oxide, 1000A thick, was grown on the titanium subhydride foils in an aqueous saturated solution of ammonium tetraborate. These anodized samples were then heat treated at temperatures between 500 and 600°C and changes in the profile of oxygen concentration as a function of depth were monitored using AES. From this data then it was possible to calculate the diffusivity of oxygen in the titanium subhydride. It was also found that electron energy loss spectroscopy (EELS) could be used to determine the titanium subhydride stoichiometry in the near-surface region. This was done by measuring the energy of the bulk plasmon loss peak, which for TiH/sub x/, varies linearly with hydrogen content. The amount of dehydriding which had occurred following a given heat treatment could be determined from profiles of the plasmon loss energy as a function of depth. A sample of anodized $TiH_{0.87}$ was studied in some detail. Significant dehydriding of this sample for heat treatment times of less than one hour, only occurred at temperatures above 550°C. Likewise, oxide dissolution was only significant at temperatures greater than 550°C. In general, for the heat treatment parameters which were chosen, the diffusivity of oxygen in $TiH_{0.87}$ was about an order of magnitude lower than that for oxygen in titanium.

46234 **(ORNL/TM—9052) Exposure of tubular ceramic heat exchanger materials to refractory coal ash from coal-oil-mixture combustion.** Ferber, M.K.; Tennery, V.J.; Willmering, J.F. (Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017290.

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Tubes of six structural ceramic materials were exposed to hot combustion gases from a coal-oil-mixture fuel. The coal ash had an extremely low base-to-acid ratio (<0.10) and an ash fusion temperature of at least 1400°C. Although a nonsticking refractory ash was expected, severe fouling was encountered throughout the exposure. This experiment (designated Ceramic Recuperator Analysis Facility Test 4) operated 460 h, including 234 h at the maximum temperature of 1300°C. In addition, several extreme temperature cycles were experienced because of combustion instability, which was apparently related to coal ash fouling. The ceramics examined included a high-purity alumina, an Si_3N_4-bonded SiC, a dense single-phase SiC, and three types of siliconized SiC. All tubes except the Si_3N_4-bonded SiC and Al_2O_3 survived without failure. Insufficient thermal shock resistance was apparently responsible for the severe cracking in these two materials. As-received and exposed materials and solidified coal slag were analyzed. In general, reactions between the coal slag and ceramic tubes were limited. We found no aggravated corrosion like that observed previously with a basic coal slag. This lack of reactivity was probably due to the highly refractory (viscous) nature of the slag. Mullite was the typical phase observed in the oxide slag matrix glass found on the tubes after the exposure. Other minor crystalline phases were present, in some cases. Several important properties, including room-temperature helium permeability and room-temperature C-ring fracture strength, were measured for both as-received and exposed specimens. No major changes in permeability were found. This was also true of the C-ring-strength for all materials examined except the Si_3N_4-bonded SiC. The strength of this material increased slightly in response to a flaw healing process facilitated by the coal slag.

46235 **(UCRL—90189) Development of accurate estimation methods for calculating thermal expansivities of hard materials.** Krikorian, O.H. (Lawrence Livermore National Lab., CA (USA)). Aug 1984. Contract W-7405-ENG-48. 25p. (CONF-8409117—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017032.

From 2. international conference on the science of hard materials; Rhodes, Greece (23 Sep 1984).

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On the basis of qualitative theoretical arguments and correlation studies, we find that the thermal expansivities, β, or borides, carbides, nitrides, and oxides can be predicted to within about +- 10% based on two parameters: ΔE/sub a/, the atomization energy, which is a measure of bond strength; and h, the microhardness, which is a measure of the steepness of the extension side of the potential energy well. The correlation is described by the relation $\beta = 21.1\ \Delta E/\text{sub a}/^{-1}(T/h)/\text{sup } 1/3/$, where ΔE/sub a/ is in kJ/g-atom and h is in kg/mm^2.

46236 **Controlled surface flaw fracture in tension and torsion.** Petrovic, J.J. (Low Alamos National Lab., NM). pp 63-75 of Fracture mechanics of ceramics. Vol. 6. Bradt, R.C.; Evans, A.G.; Hasselman, D.P.H.; Lange, F.F. (eds.). New York, NY, USA; Plenum Publishing Corporation (1983).

Actual structural ceramic components will most often be subjected to multiaxial loading, yet the vast majority of mechanical property evaluations are conducted under uniaxial loading test conditions. Because of the brittle behavior of such materials, it is imperative that a knowledge and understanding of multiaxial loading mechanical response be developed to provide assurances of component reliability under conditions closer to those dictated by actual service. Experimental data on the multiaxial loading fracture of ceramic materials are extremely limited and in many cases confusing and contradictory. Presently, no adequate data base exists on which to build realistic theoretical and predictive descriptions of such behavior. Two avenues for investigation of multiaxial loading effects are especially important. In the first, effects of stress state on the brittle fracture of ceramics with as-fabricated flaw distributions must be established. The second area deals with development of a realistic mixed-mode fracture criterion for a single, fracture-initiating flaw under generalized loading conditions involving a combination of fracture Modes I, II, and III. An investigation of initial efforts in examining the mixed-mode fracture of small, microhardness-indentation-produced surface flaws in hot-pressed Si_3N_4 is discussed. Surface flaws of this type are close to the size of as-fabricated defects yet possess a regular geometry amenable to the application of a fracture mechanics approach. Fracture of hot-pressed Si_3N_4 without artificial surface flaws was also examined in pure tension and pure torsion. All testing was performed at room temperature.

3603 Composite Materials

46237 **(LA-UR—84-2044) Carbon fiber/epoxy matrix composite springs as self-centering supports: manufacture and evaluation.** Mackay, H.A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 12p. (CONF-841055—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84014012.

From 16. national SAMPE technical conference on materials and processes; Albuquerque, NM, USA (9 Oct 1984).

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A variety of engineering and experimental applications require primary support structures which are self-centering. High mechanical strength, low-density, carbon fiber/epoxy matrix composite springs are used in unique planar, cylindrical, conical, and spherical configurations to self-center components. The sinusoidal and triangular-shaped composite springs are readily manufactured and assembled into component hardware. Design considerations, flexural strength properties, load bearing and centering data plus procedures for the manufacture of composite springs are presented.

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 36040046262

46238 **(SAND—84-6000) Method for surface modification of poly(tetrafluoroethylene).** Hirotsu, Toshihiro; Onishi, Toshitsugu. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1984. Contract AC04-76DP00789. Translation of Japanese Patent Application No. 1979-39,227. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017189.

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This invention relates to a method for surface modification of poly(fluoroethylene), and particularly to a method for modification of the surface of poly(fluoroethylene), that is effected through causing a plasma polymerization of a nitrogenous aromatic compound, on the foregoing surface to improve its adhesiveness.

46239 **(SAND—84-6001) Tetrafluoroethylene resin moldings with adhesive surfaces and bonding method for the same.** Kochi, Masaharu; Kai, Shinichiro; Yagi, Toshiharu. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1984. Contract AC04-76DP00789. Translation of Japanese Patent Application No. 1979-103,714. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017190.

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A method is disclosed for improving the adhesiveness of PTFE and PTFE-hexafluoropropylene copolymers. In this method, the surfaces are treated by evaporation of alkali metals (Na or K) or alkaline earth metals (Ca). Plasma treatment and corona discharges may also be used, and the bonding with adhesives may be performd by hot pressing. (DLC)

46240 **(ORNL-tr—5121) Stability of tin (II) 2-ethylhexanoate.** Dietsch, E.; Kloetzscher, I. Translated from *Plaste und Kautschuk ;* **22**: No. 9, 726-729(1975). Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84012759. DE84012759

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The cross-linking catalyst tin (II) 2-ethylhexanoate used in preparing polyurethane foam is investigated with regard to the effect of air on its behavior. Stabilizing mixtures for the purpose of maintaining a high tin (II)-content in the catalyst over longer periods of time are proposed.

3606 Other Materials

REFER ALSO TO CITATION(S) 36060045524, 45593, 45593, 45601, 45724, 45976, 46276, 46276, 46535

46241 **(BNL—35144) Infrared modulation of photoluminescence in glow discharge amorphous silicon.** Varmazis, C.; Hirsch, M.D.; Vanier, P.E. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 9p. (CONF-840881—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016993.

From International conference on optical effects in amorphous semiconductors; Snowbird, UT, USA (1 Aug 1984).

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Dual beam photoluminescence (PL) from a-Si:H was measured at various temperatures by exciting the sample with a modulated infrared (IR) beam in addition to a steady beam of visible light. Varying the modulation frequency revealed that the IR caused a transient enhancement of the PL, followed by a slow quenching effect. The IR excitation spectrum showed quenching by photons with energies between 0.45 and 1.1 eV, similar to the IR quenching of photoconductivity. The fast process enhanced the emission peak equally at all energies, while the slow process quenched only the high energy side of the peak. These results can be explained by the re-excitation of holes from safe traps by the IR, followed by recombination at dangling bonds.

46242 **(GEPP-TIS—763) Polarized infrared reflection spectroscopy of single crystal lithia-silicates and quartz.** McCracken, W.J.; Person, W.B.; Hench, L.L. (General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.). 19 Sep 1984. Contract AC04-76DP00656. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017059.

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The structures of single crystal lithia-silicate and quartz are characterized by polarized infrared reflection spectroscopy (PIRRS). The experimental apparatus and technique for PIRRS, along with electron channeling of lithia-disilicate, are discussed. Vibrational assignments are made for infrared reflection peaks of lithia-disilicate crystals and lithia-metasilicate crystals.

46243 **(LBL—18135) Investigation of the Si(111) surface in uhv: oxidation and the effect of surface phosphorus.** Tom, H.W.K.; Zhu, X.D.; Shen, Y.R.; Somorjai, G.A. (Lawrence Berkeley Lab., CA (USA)). Jun 1984. Contract AC03-76SF00098. 7p. (CONF-840879—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016893.

From 17. international conference on the physics of semiconductors; San Francisco, CA, USA (6 Aug 1984).

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We have studied the initial stages of oxidation, the segregation of phosphorus, and the effect of phosphorus on oxidation of the Si(111) 7 x 7 surface using optical second-harmonic generation. We have also observed a ($\sqrt{3}$ x $\sqrt{3}$)R30° LEED pattern for P on Si(111).

46244 **(N—8424330) Manifestation of the Fermi resonance in surface polariton spectra.** Puchkovskaya, G.A.; Strizhevskiy, V.L.; Frolkov, Y.A.; Chepilko, N.M.; Krivodonova, L.A. (National Aeronautics and Space Administration, Washington, DC (USA)). Jan 1984. 6p. (NASA-TM—77386). NTIS, PC A02/MF A01.

The method of disturbed full internal reflection (DFIR) is used to detect and interpret the resonance splitting of the surface polariton. The effect in the spectra of oscillatory SP which are reflected by the DFIR method in Otto geometry was experimentally recorded. It is concluded that the resonance splitting of the dispersion branch of SP may serve as an effective method for detecting weak oscillations and for measuring their parameters.

46245 **(N—8424398) Optically induced changes in the Faraday rotation spectra of the ferromagnetic semiconductor CdCr/sub 2/Se/sub 4.** Sanford, N.A. (Sperry Research Center, Sudbury, MA (USA)). Jan 1984. 2p. NTIS, PC A11/MF A01.

The chromium chalcogenide, CdCr2Se4, the most extensively studied Cr spinel, is ferromagnetic and orders at 130 K. The optical absorption edge is found to red shift for temperatures below the Curie point. Faraday rotation spectra measured near the absorption edge are highly dispersive with peak rotation increasing and shifting to the red as temperature is reduced. The rotation spectra scanned at fixed temperature display zero crossings characteristic of the temperature. The red shifting of both the absorption edge as well as the rotation dispersion result from increased magnetic order with reduced temperature. Selective repopulation of magnetically active bands by the pumping radiation is found to account for the observations.

46246 **(SAND—84-0823C) EPR linewidth studies of unpaired electrons at the Si-SiO_2 interface.** Brower, K.L. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 6p. (CONF-840878—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016727.

From Defects in semiconductors conference; Coronado, CA, USA (13 Aug 1984).

Electron paramagnetic resonance studies of the dangling bonds (P/sub b/ centers) at the (111) Si-SiO_2 interface are presented. In particular the angular variation in the P/sub b/ Zeeman resonance is dominated by Zeeman line broadening effects which could arise from strain within the silicon at the interface. The dipolar contribution to the observed linewidth is less than that expected assuming a random distribution of dangling bonds on an atomically flat (111) Si-SiO_2 interface. This observation tentatively suggests that the dangling bonds are distributed with enhanced separation. Such an effect might occur if the dangling bond formation results from the release of strain energy from a localized region at the interface. Pulsed ruby laser irradiation of the Si-SiO_2 interface at energies above the threshold for melting of the silicon increases the dangling-bond concentration by a factor of 10 and produces an angular variation in the observed linewidth which is consistent with planar dipolar broadening effects.

46247 **Channeling studies in graphite.** Elman, B.S.; Braunstein, G.; Dresselhaus, M.S.; Dresselhaus, G.; Venkatesan, T.; Wilkens, B. (Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Journal of Applied Physics;* **56**: No. 7, 2114-2119(1 Oct 1984).

The channeling characteristics of helium ions in the polycrystalline semimetal graphite have been studied using Rutherford Backscattering Spectrometry in the 1.2—2.4 MeV energy range. Axial channeling is investigated in the geometry where the ion beam is parallel to the highly preferred c-axis direction of a sample of highly-oriented pyrolytic graphite (HOPG). Assuming a Gaus-

sian distribution of crystallite orientations and measuring the energy and angular dependencies of the backscattering yield, it was possible to extract the minimum yield and the critical angle for channeling in single-crystal graphite, and the standard deviation for the spread in c-axis crystallite orientations. An unusual increase of the measured angular width for channeling with depth was observed, and is attributed to the polycrystalline nature of HOPG.

46248 **EPR studies of some f /sup n/ and d /sup n/ electronic impurities in $KTaO_3$ single crystals.** Abraham, M.M.; Boatner, L.A.; Olson, D.N.; Hoechli, U.T. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Chemical Physics;* **81**: No. 6, 2528-2534(15 Sep 1984). Contract W-7405-ENG-26.

Single crystals of the cubic perovskite host, potassium tantalate ($KTaO_3$), doped with iron group, lanthanide, and actinide impurities have been investigated using the technique of electron paramagnetic resonance (EPR). The EPR spectra of Yb^{3+} and U^{3+} have been observed for the first time in potassium tantalate by employing crystals co-doped with both impurities. Multiple doping of the material during the crystal growth process avoided the production of semiconducting $KTaO_3$ and resulted in the incorporation of adequate concentrations of the trivalent lanthanide ion Yb^{3+}. The EPR results indicate that Yb^{3+} occupies a site in which the local symmetry is axial as a result of nearby charge compensation. Pentavalent uranium is found to occupy a substitutional cubic symmetry site. EPR investigations of Cu^{2+}, Co^{2+}, Mn^{2+}, Ni^{2+}, and Fe^{3+} were also carried out.

46249 **Neutron-scattering study of ethylene motions on graphite surfaces.** Grier, B.H.; Passell, L.; Eckert, J.; Patterson, H.; Richter, D.; Rollefson, R.J. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **53**: No. 8, 814-817(20 Aug 1984). Contract AC02-76CH00016.

Quasielastic and inelastic, incoherent scattering of neutrons has been used to probe the diffusional and vibrational motions of ethylene molecules on graphite basal-plane surfaces. The experimentally observed dynamical response is found to agree reasonably well with molecular-dynamics simulations of ethylene films under similar conditions of coverage and temperature.

46250 **New electronic levels in the incommensurate crystal Rb_2ZnBr_4.** Rasing, T. (Department of Physics, University of California, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review Letters;* **53**: No. 4, 388-390(23 Jul 1984). Contract AC03-76SF00098.

The consequences of an incommensurate lattice modulation on the electronic energy levels have been studied by optical transmission experiments on Rb_2ZnBr_4. The results show the appearance of new energy levels and are analyzed with a simple tight-binding model in which the superspace symmetry of the crystal is taken into account.

46251 **Atomic structure of ion implantation damage and process of amorphization in semiconductors.** Narayan, J.; Fathy, D.; Oen, O.S.; Holland, O.W. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **2**: No. 3, 1303-1308(Jul 1984). Contract W-7405-ENG-26.

Atomic structure of ion implantation damage and the process of amorphization in silicon have been investigated using high-resolution electron microscopy techniques. The specific damage energy density for crystalline to amorphous transition has been determined to be 6.0×10^{22} eV/cm^3 or 12 eV/atom at 4 K with no annealing. The amorphous regions are produced when the damage energy deposited by the ions exceeds this critical value. Since the damage energy deposited by the ions is a strong function of ion implantation and substrate variables, the formation of amorphous regions and the process of amorphization are strong functions of these variables. The details of atomic structures of amorphous silicon containing microcrystallites and that of amorphous-crystalline interfaces are presented. The calculations of the mean-free path between collisions and the energy deposited per atom are found to be consistent with experimental observations on amorphization of silicon. Some results on the projected ranges of low-energy recoils, which are primarily responsible for the production of amorphous cascades, are presented. The solid-phase crystallization phenomena and the role of microcrystallites during the crystallization process are discussed.

46252 **Selective freezing of a dilute salt solution on a cold ice surface.** Fang, L.J.; Cheung, F.B.; Linehan, J.H.; Pedersen, D.R. (Reactor Analysis and Safety Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Heat Transfer;* **106**: No. 2, 385-393(May 1984).

The growth of a solid-liquid, two-phase region during selective freezing of a dilute, eutectic-forming, salt solution over a subcooled ice slab is investigated experimentally and theoretically. The morphology of the two-phase region and the kinetics of the solid-liquid interface observed for a NaCl-H_2O system are described photographically. The motion of the two-phase, liquidus front, recorded by a telescopic device that amplifies the local phenomena of the two-phase region is presented along with the measured transient temperature distribution of the system. Based on the assumption that the solution element of the two-phase region is in local thermodynamic equilibrium with the solid phase, a similarity model is developed to predict the dependence of the freezing rate on various controlling parameters of the system. Transient heat conduction in the ice slab is also included in the model to study the effect of the wall. Comparison is made between the analytical and the experimental results and found to be good.

46253 **Ion channeling study of radiation induced defects in a bent silicon crystal.** Wang, G.H.; Cong, P.J.; Gibson, W.M.; Sun, C.R.; Kim, I.J.; Salman, S.; Pisharody, M. (State Univ. of New York, Albany (USA). Dept. of Physics); Baker, S.I.; Carrigan, R.A. Jr. (Fermi National Accelerator Lab., Batavia, IL (USA)); Forster, J.S. *Nuclear Instruments and Methods in Physics Research;* **218**: No. 1-3, 669-672(15 Dec 1983). (CONF-830570—). Contract AC02-78ER05001.

From 6. international conference on ion beam analysis; Temple, AZ, USA (22 May 1983).

High energy proton channeling (12-120 GeV) and low energy helium ion channeling (1.5-4 MeV) have been used to study the effects of radiation damage induced in silicon by high energy (400 GeV) proton irradiation. It is shown that radiation fluence up to 10^{17}/cm^2 does not preclude deflection of high energy charged particle beams in elastically bent silicon crystals. Evidence of macroscopic segregation of residual defects in the strain field of a deformed crystal is demonstrated.

46254 **Microstructural variations in radiation hard and soft oxides observed through electron spin resonance.** Lenahan, P.M.; Dressendorfer, P.V. (Sandia National Laboratory, Albuquerque, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: 4602-4604(Dec 1983). Contract AC04-76DP00789.

Microstructural variations have been investigated in radiation-hard and -soft oxides, using electron spin resonance. It is observed that the radiation tolerance of hard and soft oxides grown in both steam and dry oxygen is correlated with two 'trivalent silicon' point defects. One trivalent silicon defect, the P(b) center, is responsible for the radiation-induced interface states. The other center, termed E-prime, appears to be the hole trap.

46255 **On the optimum method of analysis of faraday rotation and ellipticity measurements in a metal-oxide-semiconductor system.** O'Connell, R.F.; Wallace, G. (Louisiana State Univ., Baton Rouge, LA). *Journal of Physics and Chemistry of Solids;* **44**: No. 10, 951-953(1983).

The authors previously calculated the Faraday rotation / theta/ and ellipticity δ due to the two-dimensional electron gas at the oxide-semiconductor interface of a metal-oxide-semiconductor system. The results depend on such parameters of the system as the effective mass m. The relaxation time /tau/, and the electron surface concentration N, and in fact the motivation is to enable one to determine such parameters from measurements of /theta/ and δ. Here we discuss the optimum method for the determination of

these parameters from the data. In particular, we argue that it is more desirable to carry out measurements at fixed magnetic field B and variable photon frequency ω rather than at fixed ω and variable B. The authors also demonstrate how analysis can be used to determine the predicted dependence of /tau/ on magnetic field without explicit knowledge of m or N.

46256 **Thermal transport in heavily deformed and γ-irradiated LiF at temperatures near 1 K.** Cotts, E.J.; Anderson, A.C.; Shore, S.E. (Department of Physics and Materials Research Laboratory, University of Illinois, Urbana, IL). *Journal of Physics and Chemistry of Solids;* **44**: No. 9, 865-868(1983).

The thermal conductivity κ of heavily deformed LiF crystals has been measured at temperatures $T \geqq 0.5$ K following exposure of the samples to γ irradiation. The results are in agreement with recent measurements of ballistic phonon propagation in similar samples at an equivalent temperature of ≈ 4 K. A fraction of the phonons have a mean free path of order 1 cm in the heavily deformed crystal, and γ-irradiation increases the fraction having a long mean free path. The measurements support a dynamic (as opposed to static) model of phonon-dislocation interaction.

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46257 **(DOE/EV/03018—257) Physico-chemical investigation of some areas of fundamental significance to biophysics. Annual report, 1983-1984.** McGlynn, S.P. (Louisiana State Univ., Baton Rouge (USA). Dept. of Chemistry). 15 Jul 1984. Contract AS05-76EV03018. 87p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84016385.

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Research efforts are summarized on: laser photoacoustic spectroscopy of halogens, Rydberg states of methyl halides, characterization of metallodipyrromethenes, non-hydrogen bonded glasses, spectra of small polyatomic molecules, and photoionization of aromatics. (DLC)

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 40010045359, 45504, 45508, 45699, 46227, 46312, 46576

46258 (ARL/TR—060, pp 118-121) **Liquid scintillation counting of alpha-emitting nuclides of the uranium series.** Cooper, M.B.; Wilks, M.J. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

The combination of chemical separation and liquid scintillation counting in the determination of alpha emitting nuclides is discussed. The investigation was confined to samples associated with uranium mining and milling. The scintillation mixture which proved most successful comprised 200 g/l napthalene and 4 g/l (2-(4'-biphenylyl-6-phenylbenzoxazole)) PBBO in toluene. Trioctyl phosphine oxide proved a suitable extractant for thorium, uranium and polonium. Most investigations centred upon assessment using pulse height analysis, although some preliminary studies have been carried out using pulse shape analysis.

46259 (ARL/TR—060, pp 112-115) **Adsorption of natural radionuclides upon colloidal particles.** Cooper, M.B.; Ralph, B.J. (Australian Radiation Lab., Melbourne); Greiser, F. (Melbourne Univ., Parkville (Australia). Dept. of Physical Chemistry). Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

The adsorption behaviour of several radionuclides of the uranium series using colloidal metal oxides as substrates is being investigated. Of the techniques evaluated for the analysis of the solution for uranium, polarography was found unsuitable and U.V. spectrophotometry lacked sensitivity. The best approach used the radioactive tracer ^{232}U.

46260 **(CONF-840848—8) X-ray microanalysis of ion-implantation profiles in backthinned specimens.** Bentley, J.; Angelini, P. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 3p. NTIS, PC A02; 3; GPO Dep. File Number DE84016709.

From 42. annual Electron Microscopy Society of America meeting; Detroit, MI, USA (13 Aug 1984).

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As an alternative to the use of cross-sectioned specimens, a method which uses backthinned specimens has been developed for the measurement of concentration profiles in ion-implanted materials. A series of x-ray spectra is measured in a wedge-shaped, backthinned foil. The composition of the appropriate increment in foil thickness is obtained by a difference procedure. Al_2O_3 implanted with Ti ions is used as example.

46261 **(DOE/ER/00854—42) Fundamental studies of separation processes. Technical progress report, 16 July 1983-10 August 1984.** Rogers, L.B. (Georgia Univ., Athens (USA). Dept. of Chemistry). 1984. Contract AS09-76ER00854. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017041.

Excellent progress has been made in five areas. First, striking decreases in the resolutions of oligomers of poly(ethyleneglycol) have been found in adsorption chromatography when small amounts of sodium iodide are present in the eluent. This is consistent with changes reported earlier for steric exclusion chromatography. Second, if stationary phases for gas chromatography are classified as Snyder has done for liquid chromatographic solvents, the selection of the probe solvent can have a significant effect on the location of the stationary phase in the Snyder triangle. Third, going to longer columns packed with coarse beads has been shown to be advantageous in recycle gas chromatography. Fourth, a modified procedure for evaluating the relative goodness of a complex chromatographic separation has been developed. Finally, although fractionations of vanadium nonporphyrins or the ligands alone into pure species has not been successful as yet, infrared spectra have been shown to be more useful than NMR in showing differences between the fractions.

46262 **(DOE/ER/05015—T2) Mechanisms of gas permeation through polymer membranes. Progress report, July 1, 1983-May 31, 1984.** Stern, S.A.; Mauze, G.R.; Sampat, S.R. (Syracuse Univ., NY (USA). Dept. of Chemical Engineering and Materials Science). Jul 1984. Contract AC02-78ER05015. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017423.

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It has been found that the free volume and dual-mode sorption models offer a satisfactory formalism for describing the solution/sorption and transport of gases and vapors in rubbery and glassy polymers, respectively. A generalized model incorporating features of both models was developed last year. Both specialized models were tested for rubbery and glassy polymers. (DLC)

46263 **(DOE/ER/10622—5) Adsorption and desorption of hydrocarbons at low concentrations. Final technical report, 1 June 1980-31 May 1984.** Madey, R. (Kent State Univ., OH (USA)). Aug 1984. Contract AC02-80ER10622. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017264.

We measured the time-dependent transmission of hydrocarbons and their mixtures at low concentrations through adsorber beds at temperatures in the range 0 to 30°C. The beds were packed with solid adsorbents [viz., (Columbia 4LXC 12/18) activated carbon and crosslinked polystyrene]. We obtained adsorption capacities and adsorption isotherms. Summaries of experimental work for adsorption on activated carbon are tabulated. The experimental work for adsorption on crosslinked polystyrene is also summarized in tables for step-function inputs and for pulse inputs of adsorbate gases.

46264 (DOE/PC/60807—4) Supercritical fluid chromatography/supersonic jet spectroscopy. Progress report, May 1, 1984-July 31, 1984. Lee, M.L.; Goates, S.R. (Brigham Young Univ., Provo, UT (USA)). 1984. Contract FG22-83PC60807. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016199.

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Developmental work in ring-size fractionation has resulted in design improvements for the supercritical fluid extractor/fractionator. Pressure, temperature, and effluent volumes for effective ring-size separation have been determined for simple mixtures of polycyclic aromatic compounds. The performance of supercritical fluid chromatography/mass spectrometry with n-pentane as the mobile phase has been evaluated. Both electron-impact and chemical-ionization modes of operation worked well, but chemical-ionization gives the best results. Tuning of the mass spectrometer with introduction of the supercritical fluid was found to improve results. Light-scattering investigations of the flow from nozzles have led to improvements in the thermal, vacuum interface for the supersonic jet spectrometry and have begun to establish the conditions for proper expansions. Preliminary supersonic jet spectra of naphthalene with n-pentane as the carrier fluid show encouraging improvements in spectral resolution. 7 figures, 1 table.

46265 (ECN—147) Elemental analysis of human serum and serum protein fractions by thermal neutron activation. Woittiez, J.R.W. (SEE CODE- 4593600 Stichting Energieonderzoek Centrum Nederland, Petten; Amsterdam Univ. (Netherlands)). Jan 1984. 241p. NTIS (US Sales Only), PC A11/MF A01. File Number DE84702893.

Some acplications of thermal neutron activation for the determination of elemental contents in human serum and human serum protein fractions are presented. First total serum is dealt with; second serum protein fractions obtained by gel filtration are described. A brief review on the role of (trace) elements in human health and disease and a compilation of literature data for elemental contents in human serum, as obtained by neutron activation techniques, are given. The most important sources of statistical and systematic errors are evaluated. Results for the contents of sodium, potassium, magnesium, bromine, iron, copper, zinc, selenium, rubidium, cesium and antimony in serum are given, with emphasis on control of accuracy and precision. The possible relation between selenium in blood and cancer occurrence in humans is discussed. The results of elemental analyses from cancer patients and from a patient receiving a cytostatic treatment are presented. A survey of literature results for the determination of protein-bound elemental contents in serum is presented. Subsequently, results from a study on the behaviour of elements during gel filtration are discussed. Gel-element and protein-element interactions are studied. Finally the protein-bound occurrence of trace elements in human serum is determined by gel filtration and neutron activation analysis. Results for both desalting and fractionation are given for the elements bromine, copper, manganese, vanadium, selenium, zinc, rubidium, iron and iodine.

46266 (IFIN-RB—8-1982) Gas-chromatographic quantitative determination of argon in air samples, by elimination of oxygen. Sofronie, E. (Institutul Central de Fizica, Bucharest (Romania)). Aug 1982. 13p. (In Romanian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702897.

A method of gas-chromatographic quantitative determination of argon in air samples, by elimination of oxygen, is presented. Experiments were carried out in a static system. Conditions for the application of the method in dynamic systems are specified. Sensibility of the method: 5 10^{-4} cm^3 Ar per cm^3 of air.

46267 (INDC(CCP)—216/LI) File of reference data for multiple-element neutron activation analysis. Software data. Kabina, L.P.; Kondurov, I.A.; Shesterneva, I.M. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Dec 1983. 89p. NTIS (US Sales Only), PC A05/MF A01. File Number DE84702879.

Data needed for planning neutron activation analysis experiments and processing their results are given. The decay schemes of radioactive nuclei formed in irradiation with thermal neutrons during the (n,γ) reaction taken from the international ENSDF file are used for calculating the activities of nuclei and for drawing up an optimum table for identifying gamma lines in the spectra measured.

46268 (IS-T—1097) Real space solution to the phase problem in x-ray crystallography: ALCAMPS (Ames Laboratory computer-aided analysis of multi-solution Patterson superpositions). Richardson, J.W. Jr. (Ames Lab., IA (USA)). 1 Aug 1984. Contract W-7405-ENG-82. 301p. NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE84015476.

Portions are illegible in microfiche products; Thesis. Submitted to Iowa State Univ., Ames.

Beginning in the early 1930s, most crystal structures were solved from analysis of the Patterson function. In 1952, crystal structures could be solved from direct manipulation of the phases of Bragg reflections. There are, however, some structures which resist solution by direct methods. Reported here is an ab initio Patterson-based method which requires no prior knowledge about the structure. This method has been automated in the form of a computer program called ALCAMPS. This dissertation deals primarily with the theory and development of Patterson analysis, embodied in ALCAMPS, and its application. A hypothetical two-dimensional structure determination is discussed, followed by a more detailed discussion of ALCAMPS, including many of the statistical tests and calculations which contribute to the accuracy of the results. ALCAMPS has been successfully applied to the solution of sixteen structures to date. Discussions of eight of these structure solutions are included. Fourteen crystal structure determinations have been carried out during the course of this research; of these, four are discussed. The computer program PIKR is also discussed. This program calculates the positions and heights of all peaks in the Patterson or Patterson superposition maps which are used.

46269 (MINTEK-M—114) Analytical methods associated with the recovery of uranium. Dixon, K. (Council for Mineral Technology, Randburg (South Africa)). 15 Nov 1983. 41p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702896.

This report summarizes various approaches made to the analysis of materials arising from the processing of Karoo deposits for uranium. These materials include head and residue samples, aqueous solutions and organic solvents and, finally, the precipitated cakes of the elements recovered, i.e. uranium, molybdenum, and arsenic. Analysis was required for these elements and also vanadium, carbon, sulphur, and carbonate in the head and residue samples. The concentration of uranium, molybdenum, and arsenic, other than in the precipitated cakes, ranges from 1 to 2000μg/g, and that of carbon, sulphur, and carbonate from 0,1 to 5 per cent. The analysis of cakes necessitates the determination of silver, arsenic, iron, copper, calcium, magnesium, manganese, molybdenum, lead, tin, titanium, and vanadium within the range 1 to 1000μg/g, and of sodium and silica within the range 10 to 20 000μg/g. The methods used include combustion methods for carbon, sulphur, and carbonate, and atomic-absorption, X-ray-fluorescence, and emission methods for the other analytes. The accuracy of the analysis is within 10 per cent.

46270 (MINTEK-M—121) Determination of trace elements in coal by atomic-absorption spectroscopy. Kellerman, S.P.; Haines, J.; Robert, R.V.D. (Council for Mineral Technology, Randburg (South Africa)). 15 Oct 1983. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702898.

Methods based on atomic-absorption spectrophotometry, and involving various techniques for dissolution and measurement of the sample, have been developed for the determination of trace elements in coal. Non-volatile elements are determined by flame atomic absorption, and vanadium by electrothermal atomization of a solution, after ashing of the sample and dissolution of the residue with acid. Arsenic, selenium, bismuth, and tellurium are determined by hydride generation on a separate portion of the sample that has been ashed in the presence of sodium carbonate and fused with sodium peroxide. The laboratory methods are detailed in the appendices.

46271 **(NIIAR—34(549)) Distribution of zirconium in di-(2-ethylhexyl)-phosphoric acid-diluent-citric acid-diethylene-triaminepentaacetic acid extraction system and Zr effect on transplutonium and rare-earth elements separation.** Kovantseva, S.N.; Nikolaev, V.M.; Filimonov, V.T. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702902.

Extraction of zirconium (in the 0.0011-0.055 mol/l concentration range) and europium-152 and californium-252 microquantities from citrate solutions containing also variable zirconium concentrations with the solution of di-(2-ethyl-hexyl)-phosphoric acid in decane containing isooctylaz has been investigated. On the basis of experimental data a conclusion is drawn on the cation-exchange mechanism of zirconium extraction in conformity with the equation: $Zr^{4+} + 3(HA)_2$ reversible $ZrA_4x2HA + 4H^+$. It is shown that, in the presence of a complexing agent of diethylene-triaminepentaacetic acid, zirconium extraction is determined by two competing processes. One of them is related to a change in the extractant free concentration, the other one - to DTPA. Isooctylaz incorporated into the extracting mixture does not practically affect the composition of the zirconium compound extracted. It has been found that the presence of zirconium in the extraction system increases the distribution coefficients of transplutonium and rare-earth elements and practically has no effect on their separation.

46272 **(NP—4770406) Gas chromatographic determination of heavy metals in biological materials.** Maier, K. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 26 May 1981. 91p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84770406.

In the paper presented here the gas chromatographic determination of heavy metals in biological material is reported. Sodium diethyl dithiocarbamidate was used as chelating agent for the author's studies. The chelate complex was extracted with chloroform, carefully dried and redissolved in a mixture of diethyl ether and ethyl acetate. The Kovats-index of various metal chelates is given. The applicability of the method is illustrated using thallium as an example. Here the specific possibilities and difficulties which arise with thallium are described. Limit of detection: 50pg thallium.

46273 **(SSI-A—83-12) Measurement Techniques for radon in mines, dwellings and the environment.** Snihs, J.O. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Jun 1983. 18p. (CONF-8306214—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702899.

From Meeting on radiation and cancer; Stockholm, Sweden (30 Jun 1983).

Definitions and units appropriate for radon and radon daughters are given. The principle methods of detection are ionization chamber, scintillation technique, nuclear track detector, thermoluminescent discs and alpha spectrometry. The activity concentration is determined by grab sampling and subsequent measurement, frequent or continuous grab sampling and measurement and continuous sampling and long time integrated measurement. Sampling and measurement strategies for mines, dwellings and the environment are discussed.

46274 **Resonance Raman spectra of porphyrins on gamma-alumina and silica.** Streusand, B.J.; Schrader, G.L. (Center for Catalytic Science and Technology, University of Delaware, Newark, Delaware 19711 (B.J.S.) and Department of Chemical Engineering, Ames Laboratory-USDOE, Iowa State University, Ames, Iowa, 50011 (G.L.S)). *Applied Spectroscopy;* **38**: No. 3, 433-435(May 1984).

Resonance Raman Spectroscopy is used to evaluate trace contaminants of nickel and vanadiuim prophysins on gamma-alumina. Nickel tetraphenyl-porphine compounds were adsorbed on gamma-alumina and silica and Raman spectra were obtained by excitation into the visible porphyrin bands. (AIP)

46275 **Molecular Auger spectroscopy.** Rye, R.R.; Houston, J.E. (Sandia National Labs., Albuquerque, NM). *Accounts of Chemical Research;* **17**: No. 1, 41-47(Jan 1984). Contract AC04-76DP00789.

Auger Electron Spectroscopy (AES) has been shown to yield a unique local view of valence-electronic structure because of the local character of the Auger process. The ability to obtain direct valence information specific to atomic locations in a large matrix is the attribute of AES which makes it interesting and applicable to a wide variety of chemical problems.

46276 **Axial channeling studies of strained-layer superlattices.** Picraux, S.T.; Dawson, L.R.; Osbourn, G.C. (Sandia National Labs., Albuquerque, NM (USA)); Chu, W.K. (North Carolina Univ., Chapel Hill (USA)). *Nuclear Instruments and Methods in Physics Research;* **218**: No. 1-3, 57-62(15 Dec 1983). (CONF-830570—). Contract AC04-76DP00789.

From 6. international conference on ion beam analysis; Temple, AZ, USA (22 May 1983).

Also published as report SAND--83-1194 C.

Axial channeling results are presented for the analysis of strained-layer superlattices (SLSs), a broad new class of semiconductor materials with adjustable electronic properties. Insub(x)Gasub(1-x)As/GaAs periodic layer structure grown by molecular beam epitaxy were analyzed by 2 MeV He ion backscattering and channeling. Random spectra are used to obtain information on the layer thickness and composition. Channeled spectra and angular scans provide information on the lattice strain. The tetragonal distortions in the growth direction give rise to alternating tilts in inclined crystal rows at each interface. This results in significant dechanneling and narrowing of the angular scans along the [110] directions, but not along the [100] growth direction. Both the magnitude of the dechanneling with depth and the narrowing of the angular scans are directly related to the SLS lattice strain; theoretical calculations are required to determine the absolute magnitude of the strain. Results suggest the technique is sufficiently sensitive to detect lattice mismatches approx.=0.2%, corresponding to lattice distortions of 0.01 A.

46277 **Quantification of hydrogen in solids by two methods of ion beam analysis.** Madiba, C.C.P.; Sellschop, J.P.F.; Annegarn, H.J. (University of the Witwatersrand, Johannesburg (South Africa). Nuclear Physics Research Unit); Appleton, B.R. (Oak Ridge National Lab., TN (USA)). *Nuclear Instruments and Methods in Physics Research;* **218**: No. 1-3, 409-414(15 Dec 1983). (CONF-830570—).

From 6. international conference on ion beam analysis; Temple, AZ, USA (22 May 1983).

In any analytical problem, the question of rendering the measured data quantitative is demanding, and frequently sets the limit to the accuracy attainable. Quite typically, dead-reckoning methods are not feasible, and one has to resort to the use of standards or reference materials. Two established methods of hydrogen analysis in solids are the nuclear resonance reaction techniques (traditionally fluorine-19 or nitrogen-15) and (heavy) ion elastic recoil scattering. The quantitative integrity of these two methods is tested as well as the limit of detection by using carefully prepared silicon samples which have been hydrogen-implanted to two different depths at different concentrations. The two techniques are shown to give linear calibration curves when referenced to the ion implantation data. However, elastic recoil scattering is more rapid and sensitive than the resonance technique. Furthermore, the substantially higher integrated doses associated with the resonances technique result in the production of mesa growths on diamond surfaces, which is not observed with the lower doses characteristic of elastic recoil scattering.

46278 **Applications of simultaneous ion backscattering and ion-induced X-ray emission.** Musket, R.G. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Nuclear Instruments and Methods in Physics Research;* **218**: No. 1-3, 420-424(15 Dec 1983). (CONF-830570—). Contract W-7405-ENG-48.

From 6. international conference on ion beam analysis; Temple, AZ, USA (22 May 1983).

Simultaneous ion backscattering and ion-induced X-ray emission (Esub(x)>=300 eV) analyses have been performed using helium ions as probes of the first few hundred nanometers of various materials. These studies serve as a demonstration of the complementary nature of the two types of information obtained. Uncertainties associated with each of the individual techniques were re-

duced by performing both analyses. The principal advantages of simultaneous analyses over sequential analyses have been delineated.

46279 Surface structural determination of UO_2(111) using MeV ions. Thompson, K.A.; Ellis, W.P.; Taylor, T.N.; Valone, S.M.; Maggiore, C.J. (Los Alamos National Lab., NM (USA)). *Nuclear Instruments and Methods in Physics Research;* **218**: No. 1-3, 475-479(15 Dec 1983). (CONF-830570—).

From 6. international conference on ion beam analysis; Temple, AZ, USA (22 May 1983).

The UO_2(111) surface was studied using MeV ions incident along the <111> and <110> directions. In addition, this surface was well characterized by LEED and Auger analysis. A resonance at 3.05 MeV for ^4He elastic scattering from ^{16}O made it possible to study the surface peaks for uranium and oxygen simultaneously. By combining previous surface studies with detailed analysis of the surface peaks and rocking curves for this compound material, an outward relaxation of (0.19+-0.01) A was determined for uranium.

46280 Ion channeling and TEM studies of pulse melted Fe(Pd) alloys. Knapp, J.A.; Follstaedt, D.M. (Sandia National Labs., Albuquerque, NM (USA)). *Nuclear Instruments and Methods in Physics Research;* **218**: No. 1-3, 542-546(15 Dec 1983). (CONF-830570—). Contract AC04-76DP00789.

From 6. international conference on ion beam analysis; Temple, AZ, USA (22 May 1983).

Metastable Fe(Pd) surface alloys formed by deposition of layers of Pd on (100) Fe and subsequent pulsed (approx.=70 ns, 1.9 J/cm^2) electron beam melting into the bcc substrate have been investigated by ion backscattering/channelling and TEM. Repeated pulsed melting allowed examination of the epitaxial growth of the bcc substrate phase into the alloyed region for successively lower Pd concentrations. This procedure permitted detailed examination of the conditions for solidification with the fcc or bcc crystal structure and for metastable phase formation during rapid solidification. Bcc epitaxy is absent at Pd concentrations >=30 at.%, where an fcc surface layer forms. Channeling of the Pd and Fe signals was observed at Pd concentrations < or approx.16.5 at.%, where a single-phase, supersaturated bcc alloy is observed. At an intermediate Pd concentration of 22-23 at.%, both epitaxial bcc, and fcc materials are formed. The observed maximum substitutional Pd concentration in the bcc phase is about a factor of 5 greater than the maximum equilibrium solid solubility.

46281 Resonant multiphoton ionization for the detection of technetium. Nogar, N.S.; Sander, R.K.; Downey, S.W.; Miller, C.M. (Los Alamos National Lab., NM). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **380**: 291-295(1983). (CONF-830425—).

From Society of Photo-Optical Instrumentation Engineers conference; Santa Fe, NM, USA (11 Apr 1983).

The occurrence of isobaric (same mass) interferences presents a persistent problem to the precise experimental determination of isotope ratios. The problem is particularly acute when large isotope ratios must be measured, and in the determination of extremely small samples, where counting statistics will make subtraction of a background signal rather inaccurate. While there exist classical techniques for reducing background interferences, the application of resonance ionization mass spectrometry (RIMS) currently seems most likely to provide an optimal solution to this problem. A preliminary report is presented on the application of RIMS to the selective detection of technetium.

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 40020045698, 45703, 45705, 46042, 46215, 46220, 46240, 46295, 46302, 46661, 46863

46282 (AECL—6840) Formation, transformation and dissolution of phases formed on surfaces. Shoesmith, D.W. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Mar 1983. 69p. (CONF-8111211—1). NTIS (US Sales Only), PC A04/MF A01. File Number DE84702900.

From Electrochemical Society meeting; Ottawa, Canada (27 Nov 1981).

The basic mechanisms of film growth, transformation, and dissolution of phases formed on surfaces are discussed. Film growth can occur via solid-state processes or via substrate (usually metal or alloy) dissolution, followed by local supersaturation and precipitation of an insoluble phase. The phase(s) formed may be metastable and transform to a more stable phase, via either solid-state or dissolution-reprecipitation processes. Film dissolution reactions can also occur via a variety of mechanisms, including: (i) direct chemical dissolution when no oxidation state change occurs; (ii) redox dissolution when the film dissolves via a redox reaction involving a reducing or oxidizing agent in solution; and (iii) autoreduction, where film dissolution is coupled to metal dissolution. Such film-growth and dissolution processes, which often produce complex multilayer films, are common in the nuclear industry. A number of examples are discussed.

46283 (CONF-8408101—1) Aqueous inorganic phase equilibria at high temperatures: some experimental, theoretical, and applied aspects. Marshall, W. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016701.

From 1. international symposium on solubility phenomena; London, Ontario, Canada (21 Aug 1984).

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Experimental studies generally performed at this laboratory on the solubility of particular salts and oxides in dilute and concentrated aqueous solution of electrolytes at temperatures up to 400°C are presented. The techniques used are described. Some of this work applies an extended Debye-Hueckel equation as a function of the ionic strength of the solution at the high temperatures. From the variation with temperature of a particular ionization or solubility equilibrium obtained from the studies, thermodynamic functions at infinite dilution of electrolyte are calculated. The studies describe solubility behavior of sulfate salts in exhibiting retrograde solubilities with increasing temperature. But some 2-2 sulfate salts, like magnesium or nickel sulfates, hydrolytically precipitate oxysulfates or hydroxides in nearly neutral solutions at about 200°C. Other sulfate, fluoride, and phosphate salts form two liquid phases at temperatures of 250 to 400°C at saturated vapor pressures. The solubility behavior of quartz and amorphous silica in salt solutions is reviewed. Some liquid-vapor critical phenomena are also presented. The studies are shown to apply to several fields such as water desalination, power plant steam generator chemistry, geochemistry, and chemical oceanography of deep ocean hot springs.

46284 (DOE/ER/10612—11) Stable isotope studies. Progress report, March 1, 1984-February 28, 1985. Ishida, T. (State Univ. of New York, Stony Brook (USA). Dept. of Chemistry). 25 Aug 1984. Contract AC02-80ER10612. 149p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84016752.

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The large vapor pressure isotope effect (VPIE) for CH_2F_2/CD_2F_2 has been elucidated through the Gaussian-70 ab initio molecular orbital calculations using the STO-3G basis set. Results correlate well with all observed carbon and hydrogen VPIE's in liquid methane, methyl fluoride, methylene difluoride and fluoroform. The VPIE measurements of $^{14}NH_3$, $^{15}NH_3$, and $^{14}ND_3$ has been completed. The triple points 195.5 K, 195.6 K, and 199.0 K, respectively. The liquid $^{14}NH_3$/$^{14}ND_3$-pair data compare well with Armstrong but exhibit a systematic discrepancy against the results of Kirshenbaum and Urey. The solid $^{14}NH_3$/$^{14}ND_3$-pair data compare well with those of Overstreet and Giauque and extend the lower temperature limit by 10 K. The investigation of ^{15}N fractionation between liquid mixture of N_2O_3 and N_2O_4 and the gaseous oxides in equilibrium with the liquid has been completed. A new study of electrocatalytic exchange of hydrogen isotopes has been initiated. The concept of zero-th order approximation introduced to the orthogonal expansion of the zero-point energy (ZPE) enabled us to assign a value to each valence coordinate as its contribution to the ZPE. The method was applied rigorously for n-alkanes and n-alkyl chlorides.

46285 **(DOE/ER/10689—4) Reactions of metal ions and their cluster in the gas phase using laser ionization - ion cyclotron resonance spectroscopy. Progress report, July 1, 1983-June 30, 1984.** Freiser, B.S. (Purdue Univ., Lafayette, IN (USA). Dept. of Chemistry). Mar 1984. Contract AC02-80ER10689. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84016491.

This past year has seen a tremendous acceleration of progress in our study of metal ion chemistry in the gas phase using the combined laser desorption - Fourier transform mass spectrometer technique developed in our laboratory. This report briefly summarizes the highlights of the work from the first three years of funding by DOE and focuses mainly on five new areas initiated this past year and which are the basis of much of the proposed work in the renewal proposal.

46286 **(NP—4770412) Studies on the solubility behaviour of lithium in the eutectic molten salt LiCl-KCl at 400-500°C.** Meyer, M. (Dortmund Univ. (Germany, F.R.). Abt. Chemie). 17 Dec 1982. 102p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84770412.

In this dissertation the chemical potential of lithium in the melt (LiCl-KCl)sub(eut) at 400-500°C was determined as a function of the quantity of dissolved metal. For these measurements a suitable concentration chain W1 vertical stroke LiAl,Al vertical stroke LiCl-KCl vertical stroke vertical stroke LiCl-KCl + Li vertical stroke W2 with diaphragms specially developed for determining low activities or chemical potentials of lithium was used. This chain can also be used for similar studies on other metal-salt systems in particular where no solid ion conductor is available.

46287 **Structure of Ce-doped $Bi_2(MoO_4)_3$ as determined by neutron profile refinement.** Teller, R.G.; Brazdil, J.F.; Grasselli, R.K.; Thomas, R.; Corliss, L.; Hastings, J. (Sohio Research Center, Cleveland, OH). *Journal of Solid State Chemistry;* 52: No. 3, 313-319(May 1984).

The structure of Bi/sub 1.8/Ce/sub 0.2/$(MoO_4)_3$ has been refined with powder neutron diffraction data by the Rietveld method. The structure can be derived by severely distorting the scheelite structure (AMO_4) and is perhaps better written A/sub (2/3)/phi/sub (1/3)/MO_4, where phi = cation vacancy. Of the two bismuth atom sites, cerium preferentially occupies the more symmetric of the two (Bi(2) in the structure) with some cerium found in the scheelite subcell vacancies also. This site preference is understood by examining the symmetries of the two Bi sites. Crystal data: monoclinic, space group $P2_1/c$, Z = 4, a = 7.697(2), b = 11.535(3), c = 11.944(3), β = 115.19.

46288 **(UCRL-Trans—12001) Production of concentrated nitric acid.** Kargin, Y.M.; Chichirov, A.A.; Parakin, O.V.; Nikitin, E.V.; Tomilov, A.P.; Marchenko, G.N.; Garifzyanov, G.G.; Volkov, V.V.; Smolentsev, A.V.; Dobrynin, V.P. (Lawrence Livermore National Lab., CA (USA)). 1984. Contract W-7405-ENG-48. Translation of Russian Patent 1059023 A, December 7, 1983. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017191.

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A method of production of concentrated nitric acid by oxidation of a nitrogen-containing compound is distinguished by the fact that, with the goal of increasing the yield of the acid and simplifying the process, dilute nitric acid is oxidized electrochemically in a membrane cell on anodes of platinum, glass carbon or metal oxide electrodes on a titanium base at a maximum current density of 50 A/dm^2. Dioxides of ruthenium, lead and manganese, cobalt trioxide on a titanium base are used as the metal oxide electrodes.

46289 **Thermochemistry of Na_2O-WO_3 system at 1065 to 1239 K.** Lin, R.Y.; Elliott, J.F. (GTE Labs, Waltham, MA), *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* 14A: No. 8, 1713-1720(Aug 1983).

Physico-chemical properties of the Na_2O-WO_3 binary oxide system have been studied. The activity of Na_2O in Na_2O-WO_3 melts has been determined for temperatures from 1065 to 1239 K and for the composition range of N /SUB w/ (mole fraction of WO_3) from 0.5 to 0.84. It has been calculated that at 1200 K and for 0.52 < N /SUB w/ < 0.8, the relative partial molar free energy of Na_2O is G /SUP M/ /SUB N/ = 95.10 - 347.2N /SUB w/ ; (kJ/mole). For temperatures between 1065 K and 1213 K and compositions between N /SUB w/ = 0.5 and N /SUB w/ = 0.8, the relative partial molar enthalpy was found to be H /SUP M/ / SUB N/ = -709.8 + 262.58/N /SUB w/ ; (kJ/mole). The free energies of the compounds in this system were also estimated.

46290 **Decarbonylation reactions using transition metal complexes.** Doughty, D.H.; Pignolet, L.H. (Sandia National Laboratories, Livermore, CA). pp 343-375 of Homogenous catalysis with metal phosphine complexes. New York, NY, USA; Plenum Press (1983).

This chapter demonstrates that the organic products observed upon decarbonylation of a given substrate depend strongly on the catalyst and type of substrate to be decarbonylated. Different reaction products are observed, for example, when different types of acid chlorides are used with the same catalyst. Topics considered include a decarbonylation mechanism with $RhCl(PPh_3)_3$ (stoichiometric decarbonylation of acid chlorides, stoichiometric decarbonylation of aldehydes, catalytic decarbonylation of acid chlorides and aldehydes); the catalytic decarbonylation of aldehydes with cationic diphosphine complexes of Rh(I); the catalytic decarbonylation of aldehydes using cationic diphosphine complexes of Ir(I); additional studies with bis-chelate complexes of Rh(I); and the decarbonylation of benzoylchloride with $Rh(dppp)_2$.

46291 **Vibrational spectroscopy of high temperature metal-halide vapor complexes.** Papatheodorou, G.N. (Argonne National Lab., IL). *ACS Symposium Series;* No. 179, 309-325(1982).

Raman spectra of vapor-phase compounds $CuFeCl_5$, (copper-iron chloride), $HfCl_4.POCl_3$ (hafnium chloride.phosphorous oxychloride) and $NH_3.AlX_3$ (ammine.aluminum X) (X = Cl (chlorine), Br (bromine)) have been measured at approximately 500-1000 K. Resonance Raman spectra obtained from an equilibrium vapor mixture containing $CuFeCl_5$(g) showed two characteristic polarized bands at 441 and 275 cm^{-1}, which were attributed to trigonally coordinated Cu(II) and suggested a C/sub 2v/ symmetry for the vapor complex. Raman spectra of $HfCl_4.POCl_3$ vapors were characterized by a superposition of strong bands due to $POCl_3$(g) and $HfCl_4$(g) and a few new bands (at 512, 1221, and 1263 cm^{-1}) due to the vapor complex. A comparison of the vapor-complex spectra with those of $HfCl_4$(g) and $POCl_3$(g) as well as $HfCl_4$-$POCl_3$ in the liquid and glass states indicated that the bonding of the complex with a C/sub 3v/ symmetry occurs through an oxygen bridge. Raman spectra of the vapors over liquid NH_4AlX_4 (X = Cl, Br) were measured and compared with the spectra of the liquid NH_4AlX_4 itself as well as NH_3AlCl_3 in the vapor and liquid states. The measurements support the view that dissociative vaporization and further dissociation occur. For NH_3AlCl_3, the C/sub 3v/ molecular symmetry of the gaseous state is not preserved in the liquid state whose structure appears to be network-like.

46292 **(UCRL-Trans—11986) Effect of method of preparation of thoria on its catalytic activity in oxidation of carbon monoxide.** Breysse, M. Translated from *Annales de Chimie (Paris) ;* 2: 367-389(1967). Contract W-7405-ENG-48. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84016062. DE84016062

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We attempt to show the difference between the catalytic properties of thoria issued from the pyrolysis of thorium nitrate and of thorium oxalate, for the reaction $CO + 1/2\ O_2 \rightarrow CO_2$. Several methods have been used: physical adsorption of nitrogen for specific area determination; ^{11}C evaluation by counting of β radioactivity for residual carbon estimation, microgravimetry for chemisorption isotherms, measure of the electric conductivity of powders, kinetic studies of the catalysis in a quasi-static apparatus. The study of the factors influencing the precipitation of thorium oxalate shows that the specific area of the thoria increases with the dimensions of the initial oxalate crystallites. In this way, we could establish the best conditions of precipitation for the best texture of our thoria. The importance of the surface treatment of the oxide on its sorptive properties has been determined. The thoria prepared in oxygen atmosphere has its surface covered by strongly chemisorbed oxygen, which remains after prolonged heating in high vacuum. This

oxygen can be removed by treating the oxide with carbon monoxide or hydrogen. Results allow us to write following interactions between gas and solids. The thoria issued from the oxalate pyrolysis, which a n-type semiconductor, has a greater intrinsic catalytic activity than the thoria issued from the nitrate, which is a p-type semiconductor; these facts can explain the memory of catalysts and ascertain that, in both cases, the electron acceptor step is the lowest.

46293 **(LA-tr—84-34) Studies of fluorine at low temperature. Report No. 11. Reaction between oxygen and fluorine or OF_2 caused by electric discharge at low temperatures.** Aoyama, Sin'iti; Sakuraba, Syukiti. Translated from *Nippon Kagaku Kaishi (1921-47) ;* **62**: 208-213(1941). Contract W-7405-ENG-36. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017217. DE84017217

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The reactions $OF_2(l) + O_2(l)$ light $O_3F_2(s)$ and $O_3F_2(s)$ hardly occurred at all. $O_3F_2(s)$ was produced as well as $O_2F_2(l)$ when an electric discharge was conducted at a low temperature on the gas mixture of $O_2(l) + F_2(g)$. The growth of this compound is more feasible in a tube that is large enough to keep the discharge heat away. It is speculated that $O_2(l)$ is activated and develops the reaction $O_2(l) + F_2(l)$ light $O_3F_2(s)$.

46234 **(LA-tr—84-35) Studies of fluorine at low temperature. Report No. 10. I. Color of liquid fluorine. II. Photochemical reaction of liquid fluorine and liquid oxygen. III. A new compound O_3F_2.** Aoyama, Sin'iti; Sakuraba, Syukiti. Translated from *Nippon Kagaku Kaishi (1921-47) ;* **59**: 1321-1328(1938). Contract W-7405-ENG-36. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017218. DE84017218

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Pure liquid and solid fluorine is either colorless or almost colorless light yellow. Liquid fluorine reacts not only with the primary components of the glass container, alkali salts, silicon and calcium, at the temperature of liquid nitrogen and forms a fluoride, but it reacts also with oxygen compounds with these elements and grows a new compound, 2-3 oxygen fluoride. This reaction is promoted by ultraviolet radiation. A new oxygen fluoride is formed from liquid fluorine and liquid oxygen when irradiated with uv. The formula of this new oxygen fluoride compound was assumed to be O_3F_2, and it was named 2-3 oxygen fluoride. This report also covers the physical and chemical characteristics of the new compounds, 2-3 oxygen fluoride.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 40030045323, 45508, 45697, 45703, 46272, 46284

46295 **(DOE/PC/50796—T6) Diffusion of gases in porous solids: simulation and measurements. Eighth quarterly report, April 16, 1984-July 15, 1984.** Evans, J.W. (California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering). 1984. Contract FG22-82PC50796. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016292.

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This quarter experiments have been started to measure the viscosity and diffusivity of methane following a suggestion made by a review committee member at the PETC program review held in Washington in February. Viscosity data are presented. The data are seen to agree well with the predictions of the Chapman-Enskog theory. The experimental argon-nitrogen difusivity measurements carrid out over the past year have deviated somewhat from values predicted by the Chapman-Enskog theory. In an attempt to discover whether this represents an imperfection of the theory or the experiments, an error analysis has been carried out. The large possible errors were found to exist in the experimental data. The major source of error is the sensitivity of the diffusion bridge apparatus to pressure differential across the bridge. That pressure differential must be maintained at the lowest possible value during diffusion experiments in order that transport of gases through the porous plug be by diffusion (rather than viscous flow). Experiments are conducted at the limit of sensitivity of the differential pressure gauge (7.5×10^{-5} psi), and there is therefore little hope for improvement in this direction. The alternative is to use a porous plug with a smaller pore size. In the Monte-Carlo simulation of gas diffusion which makes up the theoretical phase of this investigation, the new algorithm described in previous quarterly reports is now being used to compute diffusivities for low porosity solids. 2 figures.

46296 **(LA-UR—84-2728) Infrared and neutron scattering studies of ethene adsorbed onto partially exchanged zinc A zeolite.** Howard, J.; Nicol, J.M.; Eckert, J. (Los Alamos National Lab., NM (USA); Durham Univ. (UK). Dept. of Chemistry). Aug 1984. Contract W-7405-ENG-36. 14p. (CONF-840821—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016774.

From 1. international conference on the structure of surfaces (ICSOS); Berkeley, CA, USA (13 Aug 1984).

Infrared and inelastic neutron scattering studies of ethene adsorbed onto ZnNaA zeolite show that the adsorbed molecule occupies a single adsorption site. The C-H streching modes are not observed in the infrared data but are seen as a broad band in the neutron spectrum. Some low frequency adsorbate-adsorbent modes are assigned.

46297 **(LBL—18151) Excited-state dynamics of NADH and 1-N-propyl-1,4-dihydronicotinamide.** Boldridge, D.W.; Morton, T.H.; Scott, G.W.; Clark, J.H.; Philips, L.A.; Webb, S.P.; Yeh, S.M.; van Eikeren, P. (Lawrence Berkeley Lab., CA (USA)). Jul 1984. Contract AC03-76SF00098. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016002.

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The present study reports time-resolved emission and transient absorption studies on the disodium salt of NADH and on a simple analog, 1-N-propyl-1,4-dihydronicotinamide (NPNH), in several solvents.

46298 **(NP—4770398) Syntheses using and investigating cyclopenta[b,b']dithiophenes as model substances for sulfur compounds in petroleum.** Puttins, U. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 7 May 1982. 176p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE84770398.

Sulfur compounds, such as cyclopentathiophene systems, occuring in high-boiling petroleum fractions are synthetized and analysed. Structural investigations dealt with elementary analyses, spectroscopic data and chemical reactions.

46299 **Metal-ammonia ring reduction of aromatic carboxylic acid esters.** Rabideau, P.W.; Wetzel, D.M.; Young, D.M. (Indiana Univ.-Purdue Univ., Indianapolis). *Journal of Organic Chemistry;* **49**: No. 9, 1544-1549(4 May 1984).

Although esters are often reduced to alcohols with metal-ammonia solutions, it has been found that aromatic carboxylic acid esters can be reduced efficiently to the corresponding dihydro aromatics when 1.25 equiv of water is present before metal addition. The general effect of the presence of water (before metal addition) upon metal-ammonia reduction of polycyclics was tested with anthracene (0.5 g), which was reduced to 9,10-dihydroanthracene (97% yield) in the presence of 3.5 g of water. Polynuclear aromatic esters are reduced smoothly by this technique, but in the absence of water, alkyl 9-anthroates gave a dimer assigned as axial/axial on the basis of nuclear Overhauser enhancements. Possible mechanistic pathways for dimer formation were investigated by the addition of 9,10-dihydroanthracene monoanion as well as anthracene dianion to ammonia/THF solutions of ethyl anthroate. This led to dimer and trimer formation, respectively. The structures of these compounds are discussed in light of their carbon and proton NMR spectra.

46300 **Carbon-hydrogen vs. carbon-carbon bond cleavage of 1,2-diarylethane radical cations in acetonitrile-water.** Camaioni, D.M.; Franz, J.A. (Battelle Pacific Northwest Labs., Richland, WA). *Journal of Organic Chemistry;* **49**: No. 9, 1607-1613(4 May 1984).

Radical cations of 1,2-diarylethanes and 1-phenyl-2-arylethanes (Ar = phenyl, p-tolyl, p-anisyl) were generated in acidic 70% acetonitrile-water by Cu^{2+}-catalyzed peroxydisulfate oxidation. The radical cations fragment mainly by loss of benzylic protons (C-H cleavage) rather than by alkyl C-C bond cleavage. The 1,2-diarylethanol products undergo further selective oxidation to aryl aldehydes and arylmethanols via rapid equilibration of diarylethane and diarylethanol radical cations. The radical cation of 2,3-dimethyl-2,3-diphenylbutane fragments efficiently by C-C cleavage, forming cumyl radical and cumyl cation. Oxidations of bibenzyl-bicumyl mixtures show selective oxidation of bicumyl dependent on total substrate concentration, providing evidence of equilibrating radical cations and showing that bicumyl fragments faster than bibenzyl loses protons. The effects of reaction conditions and substrate structure on reactivity are discussed.

46301 **Synthesis of dialkylamines via the reaction of organoboranes with n-chloroalkylamines.** Kabalka, G.W.; McCollum, G.W.; Kunda, S.A. (Univ. of Tennessee, Knoxville). *Journal of Organic Chemistry;* **49**: No. 9, 1656-1658(4 May 1984). Contract AS05-80EV10363.

The reaction of trialkylboranes with n-chloroalkylamines to produce a wide variety of functionally substituted dialkylamines in good yield is reported. The reaction is presumed to occur via an anionotropic migration of an alkyl group from boron to nitrogen. The possibility of a competitive free-radical reaction occurring is evidenced by the formation of alkyl chlorides as byproducts. Results of syntheses by this method are presented in one table, and data documenting the competitive free-radical reaction is contained in a second table.

46302 **Partial electron delocalization in a mixed-valence trinuclear iron(III)-iron(II) complex.** Cannon, R.D.; Montri, L.; Brown, D.B.; Marshall, K.M.; Elliott, C.M. (Univ. of East Anglia, England). *Journal of the American Chemical Society;* **106**: No. 9, 2591-2594(2 May 1984). Contract AC02-80ER10589.

Mixed-valence tri-μ-oxo iron acetates, [Fe/sup III/$_2$Fe/sup II/O(OOCCH$_3$)$_6$L$_3$], L = H_2O or pyridine, are considered from the standpoint of their intramolecular electron transfer rates. Data from Moessbauer and infrared spectra and solution redox chemistry indicate that these complexes are in the Robin and Day class II, but with appreciable electron delocalization. Adiabatic potential energy surfaces are calculated for the three-center mixed-valence case and fitted to the physical data available for the mixed-valence iron trimers.

46303 **Relative stereochemistry of the A ring of plant bile pigments.** Schoenleber, R.W.; Kim, Y.; Rapoport, H. (Univ. of California, Berkeley). *Journal of the American Chemical Society;* **106**: No. 9, 2645-2651(2 May 1984).

The synthesis and characterization, including the stereochemistry, of a series of 3,4-dihydropyrromethenones and 2,3-dihydrodioxobilins are described. High-resolution ^{1}H NMR spectral analysis allows the determination of the A ring coupling constants for a series of cis and trans model compounds. From these data and correlations, the relative stereochemistry in the A ring of phycocyanin and similar bile pigment structures can be concluded.

46304 **Preparation of 2-methylenebenzocyclobutenone by the flash vacuum pyrolysis of 3-((benzoyloxy)methyl)benzofuran.** Trahanovsky, W.S.; Amah, A.N.; Cassady, T.J. (Iowa State Univ., Ames). *Journal of the American Chemical Society;* **106**: No. 9, 2696-2698(2 May 1984). Contract W-7405-ENG-82.

2-Methylenebenzocyclobutenone (I) cannot be prepared by the same route, the flash vacuum pyrolysis (FVP) of an appropriate compound, as has been used to prepare several substituted methylenecyclobutenones, because the precursor of I would have to be an iosbenzofuran which is too reactive to be pyrolyzed under FVP conditions. A new method for the preparation of I by a route involving the FVP of 3-((benzoyloxy)methyl)benzofuran is described in detail herein.

46305 **Catalysis of the exchange of hydrogen and carbon isotopes in the water/hydrogen and bicarbonate/formate redox couples: a comparison of the exchange current densities on palladium.** Chao, S.; Stalder, C.J.; Summers, D.P.; Wrighton, M.S. (Massachusetts Inst. of Tech., Cambridge). *Journal of the American Chemical Society;* **106**: No. 9, 2723-2725(2 May 1984).

The exchange of hydrogen and carbon isotopes in the CO_2H^-/HCO_2 aqueous redox couple is reported to occur at a rate that is of the same order of magnitude as the hydrogen isotopic exchange in the H_2O/H_2 aqueous redox system. This result for experiments using a Pd-based heterogeneous catalyst suggests that formate could be formed from aqueous CO_2H^- at the Pd electrodes with reasonable efficiency compared to H_2 formation near the thermodynamic potential. The rate of formation of C-H bonds from H_2 and a CO_2 equivalent occurring under mild conditions can be considered fast when measured against the catalyzed H_2O/H_2 exchange process.

46306 **Synthesis of phenoxyamines.** Castellino, A.J.; Rapoport, H. (Univ. of California, Berkeley). *Journal of Organic Chemistry;* **49**: No. 8, 1348-1352(20 Apr 1984).

Treatment of phenols with 2,4-dinitrophenoxyamine leads to the synthesis of phenoxyamines through an amine exchange reaction. Yields for this reaction are sensitive to the pK/sub a/ of the phenol in a manner explainable in terms of a competing bimolecular decomposition reaction involving the 2,4-dinitrophenoxyamine. By use of an appropriately substituted phenol, this phenomenon can be exploited to give high yields of phenoxyamines having oxygenated substitution patterns that were unattainable by previous methods.

46307 **Ion pairing in a system continuously miscible from the fused salt to dilute solution.** Pitzer, K.S.; Simonson, J.M. (Univ. of California, Berkeley). *Journal of the American Chemical Society;* **106**: No. 7, 1973-1977(4 Apr 1984). Contract AC03-76SF00098.

Electrostatic ion pairing is well-known for highly charged ionic systems in water or for 1-1 electrolytes in solvents of low dielectric constant. Davies first presented equations for the conductance of such systems in which the solute fraction of ion pairs reached a maximum and then decreased with further increase in concentration. This apparent redissociation phenomenon is investigated by experimental measurements, theory, and model calculations. The solvent activity is measured at 373 K for the system tetra-n-butylammonium picrate in 1-butanol for which the conductance and viscosity are known. Over the measured range from solute mole fraction 0.08 to 0.94 the activity data can be fitted without ion pairing by using a simple equation including a Debye-Hueckel term and a van Laar term. But conductance data demonstrate ion pairing in more dilute solutions, and both sets of data can be fitted with a model including ion pairing. The ion distribution implied by this model is calculated. In the redissociation range the fraction of defined ion pairs does diminsh, but the total probability of finding unlike ions near one another steadily increases with increasing concentration. Thus there is redissociation only in a formal sense in terms of a particular model. 24 references, 2 figures, 4 tables.

46308 **Measurements of the thermal conductivity and viscosity of liquid propylene.** Swift, G.W.; Migllori, A. (Los Alamos National Laboratory, Los Alamos, NM). *Journal of Chemical and Engineering Data;* **29**: No. 1, 56-59(Jan 1984).

The authors have measured the thermal conductivity and viscosity of liquid propylene near room temperature. Thermal conductivity measurements were made from 5 to 56 °C and from saturated vapor pressure to about 90 bar by using a hot-wire technique; viscosity measurements were made from 10 to 60 °C and from slightly above saturated vapor pressure to about 40 bar by using a capillary viscometer calibrated with distilled water. It is estimated that the overall uncertainties to be + or - 3% for the thermal conductivity data and + or - 1.5% for the viscosity data.

46309 Polymerized surfactant aggregates: characterization and utilization. Fendler, J.H.; Tundo, P. (Clarkson Coll. of Tech., Potsdam, NY). *Accounts of Chemical Research;* 17: No. 1, 3-8(Jan 1984).

The review summarizes the current research and future directions for the use of polymerized vesicles. Methods of synthesis and characterization are described. Their potential uses in catalytic photosensitized water splitting for solar energy conversion and as drug carriers are discussed. 66 references, 6 figures.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 40040046286, 46330

46310 (DOE/ER/10861—T1) Photoelectrochemistry with chemically modified electrodes. Progress report, August 1, 1983-July 31, 1984. Spiro, T.G. (Princeton Univ., NJ (USA). Dept. of Chemistry). 1984. Contract AC02-81ER10861. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016798.

Surface enhanced Raman spectroscopy (SERS) was used to study interactions of metalloporphyrins at electrode surfaces. SERS spectra have been obtained for roughened Ag electrodes in contact with (Fe/sup III/PP)$_2$O (PP = protoporphyrin) in aqueous solution and (Fe/sup III/PPDME)Cl (PPDME = protoporphyrin dimethylester) in acetonitrile. Metalloprotoporphyrin (MPP) electrode films have been prepared by oxidative electropolymerization. The electropolymerized films had good electroactivity in contact with nonaqueous electrolytes, and the porphyrin groups were accessible to anions from the solution. Cyclic voltammetry of both ZnPP and FePP films placed in contact with aqueous electrolyte showed large anodic currents on the first scan, and no electroactivity thereafter. In the case of FePP, a small amount of O_2 was detected prior to film inactivation by ring-disk voltammetry. Catalysis of H_2 evolution by cobalt porphyrins in solution and in electrode films has been studied. Electrolysis of aqueous Co prophyrins at the Co/sup II/I/ potential has been shown by gas chromotography to produce H_2 at an accelerated rate.

46311 (DOE/ER/10968—3) Chemically modified electrodes and related solution chemistry. Technical progress report, June 1, 1983-September 1, 1984. Elliott, C.M. (Colorado State Univ., Fort Collins (USA). Dept. of Chemistry). Sep 1984. Contract AC02-81ER10968. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017110.

Portions are illegible in microfiche products.

We investigated the detailed redox chemistry, spectroscopy, and base-binding properties of the heterodinuclear complex $RuCl_2nic_4TPPCo$. We synthesized and began studies with a ferric hydroxy porpyrin which promises to be of interest as an electrochemically generated oxidation catalyst. We conducted studies with a trimeric iron complex to understand its electronic structure and evaluate it as a potential multi-electron redox reagent. We continued our work with electrodes modified with polymers of Ru(II) $(4,4'COOR\ Bpy)_3^{+2}$ with respect to their behavior as potential, practical electrochemic materials.

46312 (JINR—12-82-830) Application of foam flotation at electrolysis to concentrate of trace elements in Cheleken geothermal brines. Maslov, O.D.; Chosnovska, V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702901.

The possibility to apply the flotation to concentrate trace elements by the electrolysis of geothermal brines with the use of gelatin as a collector is shown. The effect of pH on the behaviour of the range of ions (Y, Mo, Tc, Cd, Te, Re, Os, Au, Hg, Tl and Pb) labeled with radioactive tracers in the electroflotation process of the geothermal brines was investigated.

46313 (NP—4770411) Electrochemical studies on metallic coated titanium and hafnium electrodes. Bartels, C. (Duesseldorf Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 20 Dec 1982. 200p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE84770411.

The dissertation presented here is concerned with the study of electrochemical properties of metallic coated passive hafnium and titanium electrodes. Following on from extensive studies on passive layer formation of up to now little studied hafnium and titanium the electronic properties of the passive coating were characterised by capacity and electron transfer measurement.

46314 Ionization of trifluoromethane sulfonic acid in phosphoric acid: Raman studies. Kotz, R.; Clouser, S.; Sarangapani, S.; Yeager, E. (Case Center for Electrochemical Sciences and the Chemistry Department, Case Western Reserve University, Cleveland, Ohio). *Journal of the Electrochemical Society;* 131: No. 5, 1097-1100(May 1984).

Raman spectroscopy studies indicate that the TFMSA is essentially completely ionized in H_3PO_4 and H_3PO_4-H_2O solutions for a mole fraction X /SUB TFMSA/ below 0.4. NMR measurements on the mixed acid solutions indicate only one proton spin resonance line and the expected C-13 spectrum for the $CF_3SO_3^-$. Therefore, the acid ionization processes are quite fast. The protons in the mixed acid solutions are most likely in the forms $(H_4PO_4)^+$ and $(H_3O)^+$.

46315 Mass transport of electrolytes in membranes. 1. Development of mathematical transport model. Pintauro, P.N.; Bennion, D.N. (Chemical Engineering Department, University of California, Los Angeles, Los Angeles, California). *Industrial and Engineering Chemistry Fundamentals;* 23: No. Z, 230-234(May 1984).

A model of transport across semipermeable membranes is proposed. The model is based on the Stefan-Maxwell equations and differs from previous models in that the transport parameters are considered to be functions of composition, pressure, and position within the membrane. Activity coefficient corrections and distribution coefficients at the membrane-bulk solution interface are considered. Two thermodynamic coefficients or distribution coefficients are defined along with six transport coefficients. With the concentration of fixed charge in a membrane, these parameters and equations completely define a membrane's transport performance for any set of boundary conditions. Relationships between various equivalent forms of the transport equations are defined. Experimental approaches for measuring the necessary and sufficient parameters are suggested. The thermodynamic parameters can be measured by combinations of absorption and analysis, and the six transport parameters can be defined through measuring salt and water flux for dialysis, electrodialysis, and reverse osmosis experiments.

46316 Technetium electrochemistry. 2. Electrochemical and spectroelectrochemical studies of the bis(tertiary phosphine) (D) complexes trans-$[Tc/sup\ III/D_2X_2]^+$ (X = Cl, Br) and $[Tc/sub\ I/D_3]^+$. Ichimura, A.; Heineman, W.R.; Vanderheyden, J.L.; Deutsch, E. *Inorganic Chemistry;* 23: No. 9, 1272-1278(25 Apr 1984). Contract AC02-80EV10380.

The redox chemistry of a series of the well-characterized, robust, cationic technetium complexes trans-$[Tc/sup\ III/D^2X^2]^+$ and $[Tc/sup\ I/D_3]^+$, where D = 1,2-bis(dimethylphosphino)ethane (dmpe) and 1,2-bis(diethylphosphino)ethane (depe) and X = Cl and Br, has been investigated in nonaqueous media with use of cyclic voltammetry at 25 and -40°C, spectroelectrochemistry with a gold-minigrid optically transparent thin-layer electrode, and thin-layer coulometry plus in aqueous media with use of normal pulse voltammetry. The $[TcD_2X_2]^+$ complexes undergo two electrochemical reactions in N,N-dimethylformamide (DMF), 0.5 M in tetraethylammonium perchlorate (TEAP), corresponding to the reduction of Tc(III) to Tc(II) and Tc(II) in water, acetonitrile, propylene carbonate, or DMF. The redox potentials for these Tc(II)/Tc(I) couples in propylene carbonate (0.5 M TEAP) are +0.330 and +0.166 vs. Ag/AgCl for the dmpe and depe complexes, respectively. The Tc(II) complex $[Tc(dmpe)_3]^{2+}$ undergoes further, more complicated oxidation reactions in propylene carbonate. In aqueous media the $E^{0'}$ value governing the $[Tc(dmpe)_3]^{2+}/^+$ couple is the same as it is in DMF, but the $E^{0'}$ values governing the $[TcD_2X_2]$/sup +/0/ couples are markedly shifted to more positive potentials, reflecting the water insolubility of the neutral technetium(II) complexes $[TcD_2X_2]^0$.

46317 Structure and thermodynamics of molten salts. Papatheodorou, G.N. (Argonne National Lab., Argonne, IL). pp 399-461 of Thermodynamic and transport properties of aqueous and molten electrolytes. Conway, B.E.; Bockris, J.O.M.; Yeager, E. New York, NY, USA; Plenum Press (1983).

This chapter investigates single-component molten salts and multicomponent salt mixtures. Molten salts provide an important testing ground for theories of liquids, solutions, and plasmas. Topics considered include molten salts as liquids (the pair potential, the radial distribution function, methods of characterization), single salts (structure, thermodynamic correlations), and salt mixtures (the thermodynamics of mixing; spectroscopy and structure). Neutron and X-ray scattering techniques are used to determine the structure of molten metal halide salts. The corresponding-states theory is used to obtain thermodynamic correlations on single salts. Structural information on salt mixtures is obtained by using vibrational (Raman) and electronic absorption spectroscopy. Charge-symmetrical systems and charge-unsymmetrical systems are used to examine the thermodynamics of salt mixtures.

4005 Photochemistry

REFER ALSO TO CITATION(S) 40050046291

46318 (DOE/EV/03018—252) Laser spectroscopic investigations on the photoionization and photosubstitution reactions of 9-phenylanthracene and perylene. Konuk, R.; McGlynn, S.P.; Cornelisse, J. (Louisiana State Univ., Baton Rouge (USA); Rijksuniversiteit Leiden (Netherlands)). Aug 1983. Contract AS05-76EV03018. 19p. (CONF-8308195—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017135.

From 11. international conference on photochemistry; College Park, MD, USA (21 Aug 1983).

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Photosubstitution reactions of aromatic compounds have been studied extensively by Havinga, Cornelisse and their co-workers. They found that electron transfer or charge transfer is an important step in the reaction mechanism. They have suggested that the electron ejection takes place from the lowest excited triplet state of the aromatic molecule. However, the intermediacy of singlet excited states was not ruled out. We have studied the photoionization and photosubstitution reactions of 9-phenylanthracene and perylene in polar solvents. Although solvent polarity is an important factor in the photoionization yield, we have observed that the ratio of positive and negative ions is determined by some microscopic solute-solvent interactions. Results indicate that the ionizing state is populated from the lowest singlet excited state of the aromatic molecule.

46319 Synthetic control of excited-state properties. Tris-chelate complexes containing the ligands 2,2′-bipyrazine, 2,2′-bipyrdine, and 2,2′-bipyrimidine. Allen, G.H.; White, R.P.; Rillema, D.P.; Meyer, T.J. (Univ. of North Carolina, Chapel Hill). *Journal of the American Chemical Society;* **106**: No. 9, 2613-2620(2 May 1984).

The photophysical and photochemical properties of the series of tris-chelate complexes Ru(bpy)/sub n/(bpyz)/sub 3-n/$^{2+}$, Ru(bpy)/sub n/(bpym)/sub 3-n/$^{2+}$, Ru(bpym)/sub n/(bpyz)/sub 3-n/$^{2+}$, and Ru(bpy)(bpym)(bpyz)$^{2+}$ (n = 0, 1, 2, 3; bpy = 2,2′-bipyridine, bpyz = 2,2′-bipyrazine, bpym = 2,2′-bipyrimidine) are described. From the results of temperature-dependent lifetime (210-345 K) and room-temperature emission quantum yield measurements have been obtained: (1) k/sub r/ and k/sub nr/, the radiative and nonradiative decay rate constants for the emitting MLCT manifold and (2) kinetic parameters which suggest the intervention of additional excited states. The significant points of the study are the following: (1) trends in k/sub nr/ properties are understandable based on the energy gap law, (2) low-lying dd states strongly influence lifetimes and photochemical instabilities for the complexes Ru(bpyz)$_3^{2+}$, Ru(bpym)$_3^{2+}$, Ru(bpy)(bpyz)$_2^{2+}$, Ru(bpy)(bpym)$_2^{2+}$, Ru(bpym)(bpyz)$_2^{2+}$, Ru(bpym)$_2$(bpyz)$^{2+}$, and Ru(bpy)(bpym)(bpyz)$^{2+}$ at room temperature, and (3) for the complexes Ru(bpy)$_2$(bpyz)$^{2+}$ and Ru (bpy)$_2$(bpym)$^{2+}$ there is no evidence for low-lying dd states and these and/or related mixed-ligand complexes may provide a basis for a new series of photochemically stable Ru-polypyridyl chromophores.

46320 Photophysical studies of uranyl complexes. 4. X-ray photoelectron and luminescence studies of hydrolyzed uranyl salts. Perry, D.L.; Tsao, L.; Brittain, H.G. *Inorganic Chemistry;* **23**: No. 9, 1232-1237(25 Apr 1984). Contract AC03-76SF00098.

The solid-state hydrolysis products of uranyl ion, UO_2^{2+}, have been studied with use of x-ray photoelectron and luminescence spectroscopy. The products, consisting of uranium oxides and various forms of uranyl hydroxide, gave averaged uranium 4f photoelectron binding energies of 381.5-381.8 eV and oxygen 1s binding energies of 530.8-531.9 eV. Evidence for carbon dioxide chemisorption from the atmosphere was observed by monitoring the carbon 1s line for samples that had been exposed to the atmosphere for extended periods of time. The luminescence spectra of all sets of hydrolysis products were essentially identical, consisting of two well-defined, broad peaks at 10 K. The luminescence lifetimes of each pair of bands were found to be identical within experimental error. A lifetime of 100-115 μs was observed for most samples, yielding a ground-state vibrational energy of 700-730 cm^{-1}. For other products, the emission lifetimes were significantly smaller, giving ground-state vibrational energies of less than 700 cm^{-1} and implying that counterion interactions were operable in several of the hydrolysis product mixtures.

46321 Enhanced fluorescence emission of croconate violet in ethanol containing poly(4-vinyl-pyridine). Kamat, P.V.; Fox, M.A. (Univ. of Texas, Austin). *Chemical Physics Letters;* **92**: No. 6, 595-599(12 Nov 1982).

When cronconate violet 1, a dye with strong visible absorption and reversible redox behavior, is microencaged by a polymer (polyvinylpyrrolidine) its fluorescence quantum yield increases by a factor of 8; the fluorescence lifetime increases from $<$9 ps to 28 ps. The influence of the polymer [poly(4-vinyl-pyridine)] on the photochemical properties of the dye is discussed. 13 references, 3 figures, 2 tables.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 40060045502

46322 Free radical reactions in β-methyl-D-galactopyranoside x-irradiated at 77 K and annealed to 320 K: an ESR/ENDOR study. Horning, T.; Bernhard, W.A. (Univ. of Rochester School of Medicine and Dentistry, New York). *Radiation Research;* **99**: No. 2, 262-271(Aug 1984).

X irradiation of β-methyl-D-galactopyranoside single crystals at 77 K leads to the trapping of at least three free radical products, two of which have been identified. The major free radical product is due to the loss of hydrogen from the methyl group giving a CH_2OR radical. A minor product, accounting for $\sim$8% of the spectral intensity, is an alkoxy radical centered at O4. The CH_2OR radical decays at 200 K, two-thirds of the population leading to nonradical products via recombination and one-third of the population converting to a C3-centered, deprotonated, secondary, hydroxyalkyl radical (C3-dsHA). On warming to 300 K the C3-dsHA radical converts, with a stoichiometry of $\sim$1:1, to a radical characterized by an α and β hfc tensor.

46323 Ion-induced chemistry in condensed gas solids. Boring, J.W.; Johnson, R.E.; Reimann, C.T.; Garret, J.W. (Virginia Univ., Charlottesville (USA). Dept. of Nuclear Engineering and Engineering Physics); Brown, W.L.; Marcantonio, K.J. (Bell Labs., Murray Hill, NJ (USA)). *Nuclear Instruments and Methods in Physics Research;* **218**: No. 1-3, 707-711(15 Dec 1983). (CONF-830570—).

From 6. international conference on ion beam analysis; Temple, AZ, USA (22 May 1983).

Solids of H_2O, D_2O, CO_2, and SO_2 have been bombarded by MeV and keV ions, and the sputtering of these materials investigated by measuring the total yield and the mass and energy spectra of ejected particles. One observes the results of considerable chemical

activity in these low temperature solids. With MeV ions incident on D_2O and CO_2, the production of D_2, O_2 and CO, O_2 respectively are found, while keV ions on SO_2 produce SO, SO_2, and O_2.

46324 Production and subsequent second-order decomposition of protein disulfide anions: lengthy collisions between proteins. Sommer, J.; Jonah, C.; Fukuda, R.; Bersohn, R. (Columbia Univ., New York, NY). *Journal of Molecular Biology;* **159**: 721-744(1982).

By a technique of radiation chemistry, one can convert small groups on a protein (surface disulfide bonds) into reactive centers (disulfide anion radicals) in less than 100 μs. The reactive centers on different molecules then proceed to react with each other and are destroyed. The anion radical is formed by electron transfer from transient CO_2^- generated by pulse radiolysis. The formation and decay of the disulfide anion radical were studied by monitoring its absorption at 410 nm. The area of this reactive center is very small compared to the total surface area of the protein. Nevertheless the rate of this reaction for 13 proteins ranges from 2% to 50% of the diffusion controlled rate of 3×10^9 M^{-1} s^{-1}. Billiard ball type collisions during which the protein molecules briefly touch each other do not account for these fast rates. The authors conclude that the collision has substantial duration. A radially symmetric potential holds the molecules together but allows them to roll on each others' surfaces. This conclusion, valid for 12 of 13 proteins studied, seems to be very general.

46325 Viscosity dependence of the specific rates of the diffusion-controlled reactions of the solvated electron in polar solvents. Farhataziz. (The Texas Woman's Univ., Denton, Texas 76204). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1779-1782(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

In hydroxlyic solvents, the specific rates, k, of some diffusion-controlled reactions of e /SUB s/ $^-$ with neutral molecules are proportional to /eta/ /SUP -n/ , where /eta/ is the viscosity of the solvent and n is smaller than 1. This proportionality does not hold for all situations. Specifically, for alcohol-water mixtures, the relationship of k with /eta/ is very complex. For some diffusioncontrolled reactions of e /SUB s/ $^-$ with neutral molecules in 1-alkanols, k is proportional to (L + X) /SUP -m/ , where L is the maximum linear length of the 1-alkanol molecule and X is the cavity radius of e /SUB s/ $^-$. Some implications of this proportionality are discussed.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 40070045508, 45587, 45673, 46259, 46316, 46320, 46679, 47214

46326 (ARL/TR—060, pp 78) **Chemistry and structure of technetium complexes.** Baldas, J.; Boas, J.F.; Bonnyman, J.; Williams, G.A. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

46327 (IFIN-CS—7-1983) Proton nuclear magnetic relaxation in aqueous solutions of $UO_2(NO_3)_2$ and UO_2SO_4. Ursu, I.; Demco, D.E.; Bogdan, M.; Fitori, P.; Darabont, Al. (Institutul Central de Fizica, Bucharest (Romania)). Mar 1983. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702894.

The longitudinal and the transverse relaxation rates of the ^1H nucleus in aqueous solutions of uranyl nitrate and uranyl sulphate were measured, as functions of temperature and Larmor frequency. The measurement of cation hydration number for solutions of $UO_2(NO_3)_2$ in water-acetone mixtures was performed by the proton magnetic resonance method. The solutions have been prepared from uranyl nitrate and uranyl sulphate monocrystals respectively. The experimental data are analysed, using the model which describes the nuclear magnetic relaxation, of the solvent in the presence of diamagnetic ions.

46328 (IFIN-RB—9-1982) Possible artifacts in thin layer chromatography of tritium-labelled hydrocortisone. Sofronie, E. (Institutul Central de Fizica, Bucharest (Romania)). Dec 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702905.

Artefacts appearing in thin layer chromatography of tritium labelled hydrocortisone are reported. Evidences are presented that these artifacts cause misleading results concerning radiochemical purity determination. Finally, a rapid and efficient chromatographic technique allowing the elimination of these artifacts and obtaining of an accurate value for radiochemical purity is reported.

46329 (IFIN-RB—10-1982) Radiochemical purity determination of some inorganic ions by thin layer-scanning-radiochromatography I. ^{45}Ca-calcium chloride. Sofronie, E.; Szabo, M. (Institutul Central de Fizica, Bucharest (Romania)). Dec 1982. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702895.

Some of the troubling problems encountered in paper and (or) thin layer radio-chromatography of anorganic ions are mentioned and illustrated. Reference is made on $^{45}CaCl_2$ solution. At the same time, an efficient method of separation is presented allowing to obtain a real value for radiochemical purity.

46330 (JINR—12-83-718) Adsorption of volatile metals on metallic surfaces and the possibilities of its application in nuclear chemistry. The effect of the interaction of the predicted superheavy elements with Z around 114 with various metallic electrodes on their electrodepositions. Ajkhler, B.; Rossbakh, G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1983. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702904.

The potential of electrochemical deposition of the trace amounts of a metal "A" on a metallic electrode surfaces "B" is a function of the adsorption interaction. The effects of interactions between the Ni, Pd, Pt, Cu, Ag, Au, Rh, In, Re and Fe metallic electrodes, and the trace amounts of the elements with Z=112-115 were evaluated under the conditions of the electrodeposition of these elements on the surface of the above electrodes. Conclusions are made as to the possibilities of the separation and enrichment of the predicted superheavy elements by electrochemical methods.

46331 Low-temperature synthesis of plutonium hexafluoride. Malm, J.G.; Eller, P.G.; Asprey, L.B. (Los Alamos National Lab., NM). *Journal of the American Chemical Society;* **106**: No. 9, 2726-2727(2 May 1984).

The preparation of PuF_6 by the action of dioxygen difluoride (O_2F_2) on plutonium fluorides, oxides, and oxyfluorides at room temperature or below is described. Previously, direct synthesis of PuF_6 could only be achieved by high temperature (>300°C) fluorination and by microwave or photolytic generation of fluorine atoms. Six experiments are described that illustrate the potency of O_2F_2 which is the property of this compound that indicates potential application in the nuclear industry.

46332 Effect of tellurium position on the myocardial uptake of radioiodinated 18-iodotellura-17-octadecenoic acid analogues. Knapp, F.F. Jr.; Srivastava, P.C.; Callahan, A.P.; Cunningham, E.B.; Kabalka, G.W.; Sastry, K.A. (Oak Ridge National Lab., TN). *Journal of Medicinal Chemistry;* **27**: No. 1, 57-63(Jan 1984).

The effect of tellurium (Te) position on myocardial specificity and retention of fatty acids in which radioiodide is stabilized as a trans-(E)-vinyl iodide has been evaluated in rats. Five analogues of 18-iodo-17-octadecenoic acid (ICH ? CH-R-Te-R'-COOH) with Te at positions 5, 7, 9, 11, and 13 were prepared by coupling of a trans-diiodoalkene (ICH ? CH-R-I) with the requisite sodium [(alkoxycarbonyl)alkyl]telluride substrate (NaTe-R'-COOR"; R" ? Me or Et), followed by basic hydrolysis. By varying R and R', a series of analogues with a chain length of 18 carbon atoms was prepared. The telluride substrates were generated in situ by NaBH4 reduction of the corresponding ditellurides, and the diiodoalkenes were prepared by sodium iodide-chloramine-T treatment of the corresponding vinylboronic acids [(HO)2BCH ? CH-R-I)]. The vinyl-

boronic acids were prepared by treatment of the terminal acetylenes (HC identical to C-R-I), synthesized from commercially available materials, with catecholborane. All new compounds were analyzed by TLC, NMR, MS, and elemental analyses. The ^{125}I analogues [(E)-^{125}ICH ? CH-R-Te-R'-COOH] were prepared in the same manner and evaluated in rats (four per group). Heart uptake and retention were dependent upon the Te position. The analogue with Te at position 5 showed the most pronounced (5-min values) heart uptake (3.7-4.1 dose/g), myocardial retention, and heart/blood ratios (37:1) and is a candidate for radiolabeling with ^{123}I and further evaluation as a myocardial imaging agent.

46333 **Spectroscopic and redox properties of curium and californium ions in concentrated aqueous carbonate-bicarbonate media.** Hobart, D.E.; Varlashkin, P.G.; Samhoun, K.; Haire, R.G.; Peterson, J.R. (University of Tennessee, Knoxville (USA); Oak Ridge National Laboratory, TN (USA)). *Revue Generale de Thermique;* 20: No. 4-5, 817-827(1983).

Multimilligram quantities of trivalent curium-248 and californium-249 were investigated by absorption spectroscopy, cyclic voltammetry, and bulk solution electrolysis in concentrated aqueous carbonate-bicarbonate solution. Actinide concentrations between 10^{-4} and 10^{-2}M were studied in 2 M sodium carbonate and 5.5 M potassium carbonate solutions at pH values from 8 to 14. The solution absorption spectra of Cm(III) and Cf(III) in carbonate media are presented for the first time and compared to literature spectra of these species in noncomplexing aqueous solution. It was anticipated that carbonate complexation of the actinide ions could provide a sufficient negative shift in the formal potentials of the M(IV)/M(III) couples of Cm and Cf to permit the generation and stabilization of their tetravalent states in aqueous carbonate-bicarbonate medium. No conclusive evidence was found in the present work to indicate the existence of any higher oxidation states of curium or californium in carbonate solution. Some possible reasons for our inability to generate and detect oxidized species of curium and californium in this medium are discussed.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 40080045396

46334 **(AD-A—140736/0) Prediction of thermal rate constants for combustion reaction. Final report 9 Mar 81-8 Mar 84.** Garrett, B.C. (Chemical Dynamics Corp., Columbus, OH (USA)). 1984. 12p. NTIS, PC A02/MF A01.

The goal of the research carried out on this contract is the development of theoretical methods which will aid in the interpretation and modeling of gas-phase combustion processes. The methods are based upon variational transition state theory (VTST), which has been shown to be an efficient method of computing accurate rate constants for gas-phase reactions. The study of gas-phase reactions is an important step toward understanding complicated mechanisms of the combustion of energetic materials. Also, gas-phase rate data are needed as input for models of these combustion mechanisms. The limitations in the accuracy of VTST arise from (1) a breakdown of the fundamental dynamical assumption of TST, (2) the ad hoc manner in which quantum mechanical effects are included in VTST, (3) the approximate methods for including anharmonic effects, and (4) inaccuracies in the potential energy surface information used as input into the theory. The major part of the research on this contract has included extension of the methods to surmount these limitations, validation of the new methods by testing them against accurate quantum mechanical methods on model collinear reactions, and extension of the methods to treat realistic reactions involving polyatomic molecules.

46335 **(AD-A—140738/6) Prediction of transition states and thermochemistry for combustion reactions. Final report 4 Aug 80-31 Dec 83.** Bartlett, R.J. (Battelle Columbus Labs., OH (USA)). 7 Apr 1984. 109p. NTIS, PC A06/MF A01.

Ab initio quantum chemistry methods based upon many-body perturbation theory (MBPT) and coupled-cluster (CC) theory have been developed and applied to potential energy surfaces for transient molecules. Studies included decomposition pathways for formaldehyde, methanol, the formyl radical and the inorganic radical HIF. MBPT/CC methods were extended to include effects of triple-excitations and comparisons made with full CI for HF, BH, NH3 and H20. The high accuracy of MBPT/CC has been demonstrated.

46336 **(AD-A—140767/5) Laser probes of propellant combustion chemistry. Final report 30 Sep 80-31 Jan 84.** Crosley, D.R.; Smith, G.P.; Golden, D.M. (SRI International, Menlo Park, CA (USA)). 29 Mar 1984. 201p. (SRI-MP—84-053). NTIS, PC A10/MF A01.

Laser-induced fluorescence (LIF) can be used to measure the atomic, diatomic, and triatomic free radicals that are the intermediates in combustion chemistry. Coupled with detailed models, which incorporate a sound and consistent set of reaction rate constants, such measurements can lead to an understanding of that chemistry, having predictive value for use under experimentally difficult conditions. This report describes the development of LIF techniques, the applications of such techniques of flames and to laser pyrolysis/laser fluorescence kinetics experiments, studies of rate constant estimations and detailed modeling of combustion chemistry. The chemistry studied is that of combusting mixtures of CH4/N2O, CH2O/N2O, CH2O/NO2, and related compounds. These contain the chemical networks, individual reactions, and radical species present in the gas-phase combustion of nitramine propellants, such as HMX and RDX. The tasks described are LIF diagnostic studies on O, N, OH, NCO, and NH2 in flow systems and flames, rate constant estimation studies for unimolecular decomposition of CH2O and several hydrocarbons, modelling of the CH2O/N2O flame, and laser pyrolysis/laser fluorescence studies of CH4/N2O and CH2O/N2O chemistry.

46337 **(AD-P—003143/5) Soot formation in diffusion flames.** Kent, J.H.; Wagner, H.G. (Sydney Univ. (Australia). Dept. of Mechanical Engineering). 1984. 11p. NTIS, PC A02/MF A01.

Soot measurements in laminar and turbulent diffusion flames are reviewed. In laminar flames, soot particles have high formation rates near the reaction zone and growth takes place in the fuel rich interior. Optical methods have revealed the regions of these separate processes with good spatial resolution. Sampling and optical techniques have been applied to turbulent flames to determine parametric influences upon soot formation and burnout rates. Recent experimental evidence indicates that formation rates can be mixing or chemically controlled. Burnout rates are additionally very influenced by temperature. Under simple conditions the smoking propensity of a flame may be determined only by the temperature near the tip.

46338 **(AD-P—003144/3) Growth of electrically charged soot particles in flames.** Homann, K.H.; Stroefer, E.; Wolf, H. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Physikalische Chemie). 1984. 10p. NTIS, PC A02/MF A01.

A part of the soot particles in fuel-rich hydrocarbon flames carry an electric charge. Charges of both signs occur on soot particles in the same flame. Through a molecular beam sampling system, charged soot particles and smaller ions have been drawn from low pressure flames of acetylene and benzene and analyzed in an electrostatic mass filter and a deflection system. The development of particle mass, number density and the volume fraction of charged and neutral soot is reported for these flames under different burning conditions. The volume fraction of charged soot in acetylene flames increases with temperature while there are no large charged soot particles at all in benzene flames. The role of charged species in the mechanism of soot formation and the process of charging is discussed in terms of a chemiionization mechanism.

46339 **(AD-P—003145/0) Formation and destruction of organic pollutants in thermal systems and flames.** Lahaye, J.; Prado, G.; Garo, A. (Centre de Recherches sur la Physico-Chemie des Surfaces Solides, Mulhouse (France)). 1984. 19p. NTIS, PC A02/MF A01.

The main pollutants formed in thermal systems are soot, cenospheres, polyacromatic hydrocarbons and cyclic molecules includ-

ing heteroelements such as oxygen and nitrogen. PAH are produced through reactions between aromatic and unsaturated aliphatic structures. PAH are intermediate species in soot formation. Some PAH, however, remain in flames and can be adsorbed on soot particles. In flames, hydroxyl radicals are responsible for soot post-combustion. Some practical results on soot production in turbines are reviewed.

46340 **(AD-P—003146/8) Optical measurements of soot size and number density in a complex flow, swirl-stabilized combustor.** Samuelsen, G.S.; Wood, C.P.; Jackson, T.A. (California Univ., Irvine (USA). Combustion Lab.). 1984. 15p. NTIS, PC A02/MF A01.

In-flame optical measurements of soot particulates in a turbulent, recirculating (i.e., complex flow) model laboratory combustor are described. A nonintrusive optical probe based on large angle (60, 20 degs) intensity ratio scattering was used to yield a point measurement of particulate in the size range of 0.08 to 0.38 microns. Performance of the optical technique was evaluated, and an exploratory assessment of the spatial distribution of soot was conducted with attention to fuel molecular structure, fuel loading, and a smoke-suppressant additive (ferrocene). Isooctane and mixtures of isooctane with various ring and aromatic compounds blended to yield the smoke point of a JP-8 stock were prevaporized and introduced through a hollow cone nozzle. Addition of ring compounds to the base isooctane substantially changed the distribution of soot and increased the overall emission by 300%. Production of soot was substantially reduced by a decrease in fuel loading, and marginally reduced or not affected by the additive depending on fuel structure. The optical technique is a potentially powerful tool for providing the experimental evidence necessary to understand the processes of soot formation and burnout in complex flows typical of gas turbine combustors. However, scanning electron micrographs of extracted samples established that the technique is limited to the large particle wing of the soot size distribution, and optical and electronic processing can induce biasing and uncertainties which must be understood and controlled before the potential of the technique can be fulfilled.

46341 **(DOE/ER/10970—3) Ionic aspects of soot formation. Progress report.** Koski, W.S. (Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Chemistry). Aug 1984. Contract AC02-81ER10970. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016255.

Studies of some ion-molecule reactions pertinent to combustion are mentioned only briefly. Hydrocarbon cluster ions are studied: heats of formation of $C_3H_7^+.CH_4$, $C_2H_5^+.C_2H_2$ and $C_2H_5^+.C_2H_2$ were determined. Reactivity of these cluster ions were also studied. Reactions of monocarbon hydrocarbon ions (CH_4^+, CH_3^+, CH_5^+) with acetylene to produce $C_3H_3^+$ were studied. (DLC).

46342 **(N—8422788) Thermal characteristics of plasma reactors with cylindrical and conical multijet mixing chambers.** Burov, I.S.; Yermolayeva, Y.M.; Zabrodin, V.K.; Mosse, A.L. (Joint Publications Research Service, Arlington, VA (USA)). Apr 1984. 2p. NTIS, PC A03/MF A01.

An experimental study of plasma reactors was made for a comparative efficiency analysis of cylindrical and conical mixing chambers. Also determined were the heat losses to electrodes in the electric-arc heater and to walls of the multijet mixing chamber, both depending on the input power and the mode (tangential or radial) of plasma jet injection. The resuls reveal that the efficiency of any mixing chamber increases with increasing enthalpy of the gas and, at constant enthalpy, with increasing gas flow rate. The higher effiency of a conical mixing chamber, despite the larger radial temperature gradient, is attributed to a thicker thermal boundary layer. Also yielded was data on the motion of disperse silica in gaseous suspension axially injected into the mixing chamber.

46343 **Mixed convective burning of a fuel surface with arbitrary inclination.** Mao, C.; Fernandez-Pello, A.C.; Pagni, P.J. (Department of Mechanical Engineering, University of California, Berkeley, California 94720). *Journal of Heat Transfer;* **106**: No. 2, 304-332(May 1984). Contract W-7405-ENG-48.

An analysis is developed for mixed, forced, and free convective combustion on a flat fuel surface of arbitrary inclination that makes use of the laminar boundary layer approximation to describe the gas flow and of the flame-sheet approximation to describe the gas-phase reactions. A mixed-convection parameter (Re/sub x//sup n/+Gr/sub x//sup m/)/sup 1/2n/ that properly scales the dependent and independent variable fields and a mixed convection ratio (Gr/sub x//sup m//Re/sub x//sup n/)/sup 1/2/ that plays the role of the downstream local similarity coordinate are introduced in the nondimensionalization of the equations. It is shown that these two parameters, rather than the standard Reynolds, Re/sub x/, and Grashof, Gr/sub x/, numbers are the optimum choice of governing nondimensional groups for this problem. The values of m and n are selected to obtain a similarity solution of the governing equations in the pure free convection limit for a vertical (m = 2, n = 4) and a horizontal (m = 2, n = 5) surface, which are the cases solved in this work. With this formulation, the solution of the problem provides for both cases smooth transition of all physical variables from one convective limit to the other. Results are obtained from numerical integration of the governing equations and from application of the local similarity approximation. It is shown that the range of validity of local similarity is extended beyond that obtained with alternate formulations and that the proper limits are approached. For use in practical applications, the results suggest that explicit expressions for the mass burning rate and for the fraction of unburnt pyrolyzate can be found that will suffice over the whole range of mixed-flow intensity.

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4201 General Engineering

46344 **(UCID—18822-Rev.1) NIKE3D: an implicit, finite-deformation, finite element code for analyzing the static and dynamic response of three-dimensional solids. Rev. 1.** Hallquist, J.O. (Lawrence Livermore National Lab., CA (USA)). Jul 1984. Contract W-7405-ENG-48. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017161.

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This report provides a user's manual for NIKE3D, a fully implicit three-dimensional finite element code for analyzing the finite strain static and dynamic response of inelastic solids, shells, and beams. A contact-impact algorithm permits gaps and sliding along material interfaces. By a specialization of this algorithm, these interfaces can be rigidly tied to admit variable zoning without the need of transition regions. Spatial discretization is achieved by the use of 8-node constant pressure solid elements, 2-node truss and beam elements, and 4-node membrane and shell elements. Bandwidth minimization is optional.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 42020045307, 45638, 45640, 45642, 45643, 45948, 46143, 46434, 46493, 46501, 46516, 46556, 47108

46345 **(AD-A—140665/1) Superconductivity for electromagnetic guns. Final report 17 Sep 82-17 Sep 83.** Mawardi, O.K. (Collaborative Planners, Inc., Cleveland Heights, OH (USA)). Mar 1984. 85p. NTIS, PC A05/MF A01.

This report deals with a feasibility study for an electromagnetic gun using superconducting components. The report discusses two questions. The first deals with an assessment of the applied superconductivity technology, while the second is concerned with two reference designs for coaxial accelerators making use of advanced energy transfer concepts. Impressive recent developments in the technology of cryogenic insulation and of liquid helium liquefiers, as well as, of commercially available super conductors makes it possible to construct superconducting pulsed power sources of very high efficiency and of remarkable compactness and low weight. Repetitive superconducting switches, together with superconducting storage inductors makes these pulsed sources very competitive with conventional sources in terms of reliability and time constant. The synchronous coaxial accelerators investigated in

this report rely on a simple procedure that eliminates the need for switches. It is based on the concept of transferring the energy of the pulsed source to a transmission line. The driver coils are part of the transmission line. Consequently, as the pulse travels down the line, the coils are excited in sequence and in synchronism with the moving driven coil. Since the energy is transferred from the pulsed source to a transmission line which appears as a resistive load, the transfer efficiency is very high. Other features of the novel designs consist in maintaining the current in the driven coil to a very low value thus minimizing the problem of arcing at the brushes and in dealing with the high voltage required to drive the guns.

46346 **(AD-A—141326/9) Demonstration of SQUID (Superconducting Quantum Interference Device) parametric amplifier. Interim report 1 Oct 83-15 Mar 84.** Silver, A.H.; Sandell, R.D.; Phillips, R.R.; Smith, A.D. (TRW Space and Technology Group, Redondo Beach, CA (USA). Advanced Products Lab.). 15 May 1984. 34p. NTIS, PC A03/MF A01.

TRW has been developing low noise microwave parametric amplifier with Josephson junction SQUIDs (Superconducting Quantum Interference Devices). This report summarizes the second phase of the program which includes measurement of the amplifier performance at X-band, and design and fabrication of a SQUID array amplifier. We have demonstrated gain in excess of 10 dB at 8.4 GHz and a measured noise temperature equal to 6K with an uncertainty of (+15/-7)K. Arrays with both 25 and 50 elements and 50 ohmi impedance have been designed and fabricated. These arrays should increase the dynamic range of the amplifier.

46347 **(CONF-840872—23) Photoacoustic study of photon absorption in diffraction gratings.** Arakawa, E.T.; Inagaki, T.; Goudonnet, J.P. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016630.

From SPIE annual technical symposium; San Diego, CA, USA (19 Aug 1984).

Absorption of 633-nm photons in silver-coated diffraction gratings was studied by a photoacoustic method. The measurements were made as a function of the ruling orientation relative to the plane of photon incidence, and special attention was paid to plasmon resonance absorption in conical diffraction geometries. The results obtained were compared with predictions from perturbation theory.

46348 **(MLM—3140(OP)) Helium-4 second virial in low temperature gas thermometry: comparison of measured and calculated values.** McConville, G.T. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1984. Contract AC04-76DP00053. 3p. (CONF-840842—29). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016940.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

Recent advances in low temperature gas thermometry down to 2.6K have led to the gas thermometer to be considered as a low temperature interpolation instrument for the International Practical Temperature Scale below 13.81K. Work on reducing the uncertainty in the low temperature second virial has appeared in Temperature, Vol. 5. The data of Berry, Plumb, Kemp, and Steur, et al, are compared here to values calculated using the HFDHE2 potential function of Aziz, et al. Below 10K the data fall significantly lower than the calculation. Modifications of the HFDHE2 potential show an increased well depth to 10.916K and the inclusion of a He_2 bound state energy of 1.9 mK describes Berry's data down to 2.6K. The agreement ranges from 0.3 cc/mole at 2.6K to 0.1 cc/mole at 20.28K. 11 references.

46349 **(NP—4770396) Report on activities in the mining industry in 1982.** (Rheinisch-Westfaelischer Technischer Ueberwachungs-Verein e.V., Essen (Germany, F.R.)). 1983. 41p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84770396.

The report describes the safety situation of those plants within the competence sphere of the "Technical Control Authorities" (TUeV) of Northrhine-Westphalia, Rhineland, and Hannover which need to be examined and which are controlled by the mining control authority in Northrhine-Westphalia. The report refers to the spheres of machine technology, emission and immission measurements, electrotechnical and winning systems.

46350 (NP—4770405, pp 283-298) **Development and construction of a temperature deep-borehole probe.** Zoth, G.; Fesche, H.W.; Haenel, R. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

A computer-aided borehole temperature measuring equipment for temperatures of up to 260°C and ambient pressures of up to 1,300 bar was developed and constructed in the Niedersaechsisches Landesamt fuer Bodenforschung (Lower Saxony Board for Soil Research (NLFBJ) in cooperation with the Prakla-Seismos company. The measuring equipment is installed on a vehicle owned by the NLFB. The selection of the materials and construction components employed necessitated comprehensive test measurement concerning temperature and pressure. Measurement data were acquired, corrected and demonstrated by means of an HP computer. The measuring probe was calibrated in a pressurized chamber which can be heated up to 280°C. The first test measurements were implemented in a c. 1,900 m deep borehole with positive results.

46351 (NP—4770405, pp 299-306) **Borehole geophone for super-depths.** Wierczeyko, E. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

The development of geophone systems of a 260°C configuration had been continued to such an extent that construction of vertical system could be started. Various electric and mechanic construction elements as well as materials, fats and oils were acquired and tested for their applicability. The geophone probe in sample configuration and the associated surface device are ready for operation and will enter field testing on completion of improvements on the reliability of pressure-contact system.

46352 (NP—4770405, pp 307-320) **Development and testing of a borehole gravimeter.** Berkhahn, W.; Gauthier, W.; Scheurenbrand, H. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

Owing to the specification requirements, espec. those of measuring accuracy, resolution, measuring range and mechanical dimensions, a borehole-gravimeter sensor was developed which makes extreme demands on precision-mechanical manufacturing technology due to its 37 mm external diameter. Along with a novel development of the sensor concept (Patent applied for), new technologies had to be created for manufacturing the sensor. By means of substantial additional achievements in the field of sensor development and development of manufacturing technologies, it was necessary to change activity schedule which resulted in a capable sensorprototype with a levelling device. The probe will be developed in a follow-up project, testing is envisaged as a sub-task to a current or planned future borehole project.

46353 **(ORNL/CSD/TM—220) GROTESQUE without tears.** Knight, J.R. (Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017647.

The purpose of this report is to demonstrate the capability of the KENO V.a Monte Carlo criticality program in modeling and calculating a critical experiment with relatively complex geometry. This experiment, consisting of an assembly of various pieces of uranium metal, has been given the name GROTESQUE. The steps taken to calculate this experiment using KENO V.a are described. A detailed description of the experiment and the input data used for the calculation are given.

46354 Optimization of next-event estimation probability in Monte Carlo shielding calculations. Hoffman, T.J.; Tang, J.S. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **46**: 654-655(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

46355 Performance limits for smooth-wall, gravity-assisted heat pipes. Prenger, F.C. (Los Alamos National Laboratory, Los Alamos, NM); Kemme, J.E. (Stuttgart, Universitaet, Stuttgart, West Germany). *AIAA Paper;* No. 83-1433, 1-5(1983). (CONF-830629—).

From 18. AIAA thermophysics conference; Montreal, Canada (1 Jun 1983).

Performance limits for vertical, smooth-wall heat pipes were obtained from experiments performed at the IKE of the University of Stuttgart and at the Los Alamos National Laboratory. The data are correlated with parameters derived from flooding in countercurrent, two-phase flows. Tests using smooth-walled, wickless heat pipes demonstrate the applicability of two-phase flow correlations for predicting performance limits in gravity-assisted heat pipes.

4203 Lasers

REFER ALSO TO CITATION(S) 42030045499, 47132

46356 (LA-UR—84-2620) High-repetition rate, inductively stabilized, long-pulse excimer laser. Sze, R.C. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 7p. (CONF-840899—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016827.

From 5. international symposium on gas flow and chemical lasers; Oxford, UK (20 Aug 1984).

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A high-repetition rate double discharge head laser is developed taking advantage of the increased pulse repetition rate capabilities of inductive stabilization.

46357 (N—83-34306) Theoretical studies of solar-pumped lasers. Harries, W.L. (Old Dominion Univ., Norfolk, VA (USA)). Jul 1983. 38p. (NASA-CR—173016). NTIS, PC A03/MF A01.

Metallic vapor lasers of Na2 and Li2 are examined as solar energy converters. The absorbed photons cause transitions to vibrational-rotational levels in an upper electronic state. With broad band absorption the resultant levels can have quantum numbers considerably higher than the upper lasing level. The excited molecule then relaxes to the upper lasing level which is one of the lower vibrational levels in the upper electronic state. The relaxation occurs from collisions, provided the molecule is not quenched into the ground level electronic state. Lasing occurs with a transition to a vibrational level in the lower electronic state. Rough estimates of solar power efficiencies are 1 percent for Na2 and probably a similar figure for Li2. The nondissociative lasers from a family distinct from materials which dissociate to yield an excited atom.

46358 (N—83-34307) Mini-cavity-dumped laser. Final report, September 1980-September 1981. Reed, E. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Dec 1981. 46p. (NASA-CR—170569; CONF-811229—14). NTIS, PC A03/MF A01.

From International conference on lasers (Society for Optical and Quantum Electronics); New Orleans, LA, USA (14 Dec 1981).

Lasers for use in high precision satellite ranging systems consist typically of an oscillator followed by several amplifier stages. While the shortest optical pulses are achieved by using a mode locked oscillator, such an oscillator is incompatible with the compact design needed in future, highly mobile systems. The laser oscillator achieves pulse lengths approaching those obtainable by mode locking, but in a much more compact and stable design. The oscillator uses two LiNbO3 Pockels cells inside the resonator. One Q-switches the oscillator, and the other is used in a pulse slicing scheme to cavity dump a portion of the circulating optical energy. The length of the optical output pulse measured at 425 + or - 50 picoseconds.

46359 (N—84-12890) Possibility of amplifying infrared radiation by high-pressure reacting gas. Kochelan, V.A.; Kubibnyy, Y.A. (Air Force Systems Command, Wright-Patterson AFB, OH (USA)). Jun 1983. 11p. (AD-A—131086; FTD-ID(RS)T—0569-83). NTIS, PC A02/MF A01.

The process of stimulated light emission which is preceded by a chemical reaction, from which populated molecules are formed is being investigated.

46360 (N—8424385) Turbulence and 1/f noise in quantum optics. Arecchi, F.T. (Florence Univ. (Italy)). Jan 1984. 6p. NTIS, PC A11/MF A01.

An exciting chapter of physics was the study of fluctuations and coherence in lasers: how atoms or molecules, rather than radiating e.m. field independently, decide to cooperate to a single coherent field then, for still higher excitation, how and why they organize in a complex pattern of space and time domains, with small correlations with one another (optical turbulence). These new features of quantum optical systems are discussed.

46361 (N—8424423) Polarization switching with J + 1/2 to J - 1/2 atoms in a ring cavity. Sandle, W.J.; Hamilton, M.W.; Ballagh, R.J. (Otago Univ., Dunedin (New Zealand). Dept. of Physics). Jan 1984. 3p. NTIS, PC A11/MF A01.

A steady state theory for the polarization behavior of the output of a ring optical cavity that contains a vapor of atoms with a drawn J + 1/2 to J - 1/2 transition are reported. The input laser radiation may have arbitrary polarization and detuning. A previously reported theory is extended to include detunings and magnetic fields.

46362 (N—8424445) Polarization switching with sodium vapour. Hamilton, M.W.; Sandle, W.J. (Otago Univ., Dunedin (New Zealand). Dept. of Physics). Jan 1984. 2p. NTIS, PC A11/MF A01.

Results are given of an experiment which demonstrates switching of the polarization state of the output of a near-concentric Fabry-Perot containing sodium vapour, excited via the homogeneously broadened Dl transition. An example of the output, for linearly polarized laser input, at 1.5 GHz below line center shows switching with hysteresis at high input power (approximately 400 mW) due to saturation, as well as the switching at lower power (approximately mW) due to optical pumping effects. Purely absorptive polarization switching at approximately 50 mW input power was observed. Polarization switching has been predicted in the context of three state atoms in an optical cavity, and the lower power switchin has been previously observed using the inhomogeneously broadened Dl transition of sodium in a Fabry-Perot with the laser detuned above line center. By using argon buffer gas at up to 100 torr, importance of hyperfine structure and inhomogeneous broadening was reduced so as to make the transition approximate a J + 1/2 to J - 1/2 transition.

46363 Mini-TEA 1000-Hz CO_2 laser. Brown, R.T. (United Technologies Research Center, Silver Lane, East Hartford, Connecticut 06108). *Applied Optics;* **23**: No. 15, 2485-2487(1 Aug 1984).

Typical performance data from a 1-kHz CO_2 laser are discussed. Pulse energies in excess of 250 mJ at repetition rates up to 1000 Hz were obtained from a 1- x 1- x 50-cm active volume. Long-term operation (>15 min) was demonstrated at a repetition rate of 400 Hz.

46364 Flashlamp-pumped Styryl 9 dye laser. Cheng-Huei Lin; Marshall, B. (EG & G Energy Measurements, Inc., P.O. Box 98, Goleta, California 93116). *Applied Optics;* **23**: No. 14, 2228-2228(15 Jul 1984). Contract AC08-83NV10282.

The output energy and tuning characteristics of a Styryl 9 dye laser were studied for different dye concentrations and solvents. (AIP)

46365 **Stimulated rotational Raman scattering in CO2-pumped para-H2.** Carlsten, J.L.; Wenzel, R.G. (Los Alamos National Lab., NM). *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **QE-19**: 1407-1413(Sep 1983).

Stimulated rotational Raman scattering in a 300 K multipass cell filled with para-H2 with a single-mode CO2 pump laser was studied using a single-mode OPO as a probe laser at the Stokes frequency for the So(0) transition. Amplification and pump depletion are examined as a function of incident pump energy. For an incident CO2 pump laser energy of 1.5 J, a photon conversion efficiency of 47 percent is observed.

46366 **Injection-locking unstable resonator excimer lasers.** Bigio, I.J.; Slatkine, M. (Los Alamos National Lab., NM). *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **QE-19**: 1426-1436(Sep 1983).

The recent development of a highly efficient excimer laser injection-locking technique is described and some details and consequences of the technique are presented. Practical and quantitative experimental considerations of the technique are addressed, including a comparison of cavity/injection configurations, power oscillator (PO) discharge and cavity, injection-hole diameter, reference oscillator, angular alignment of injected beam PO, timing, the distance between PO and the reference oscillator, and longitudinal mode matching. Experiments carried out with KrF and XeF systems to probe some of the limitations of the injection-locking process are reviewed, and the first demonstrations of phase conjugation of UV excimer laser beams performed with the discussed injection-locked systems are briefly described.

46367 **Evolution of long pulses in a tapered wiggler free electron laser.** Goldstein, J.C. (Los Alamos National Lab., NM). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **380**: 131-138(1983). (CONF-830425—).

From Society of Photo-Optical Instrumentation Engineers conference; Santa Fe, NM, USA (11 Apr 1983).

The evolution of a long pulse (pulse length much greater than the slippage distance) in a tapered wiggler free electron laser oscillator is studied by numerical solution of the one dimensional theoretical model for a realistic set of magnet, electron beam, and optical resonator parameter values. Single pass gain curves are calculated for low and high light intensities. It was found that an initial, low amplitude, incoherent pulse grows into a coherent pulse whose growth rate agrees with the calculated small signal gain curve. The transient evolution of coherent pulses is calculated for several different cavity length detunings, and a quasi-steady state desynchronism curve is obtained. Detailed pulse properties at two points of the desynchronism curve are given. The frequency changing behavior (chirping) of the optical pulse during transient evolution is examined.

46368 **High-efficiency free-electron-laser experiments.** Boyer, K.; Brau, C.A.; Goldstein, J.C.; Hohla, K.L.; Newman, B.E.; Stein, W.E.; Warren, R.W.; Winston, J.G. (Los Alamos National Lab., NM). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **380**: 128-130(1983). (CONF-830425—).

From Society of Photo-Optical Instrumentation Engineers conference; Santa Fe, NM, USA (11 Apr 1983).

Experiments with a tapered-wiggler free-electron laser have demonstrated extraction of about 3% of the energy from the electron beam and measured the corresponding optical emission. These results are in excellent agreement with theory and represent an order-of-magnitude improvement over all previous results.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 42040045899, 45900, 45995, 46295, 46343

46369 **(DOE/ER/10916—1) Symposium on turbulence.** Patterson, G.K.; Zakin, J.L. (eds.). (Missouri Univ., Rolla (USA). Dept. of Chemical Engineering). 1983. Contract FG02-81ER10916. 440p. (CONF-8109248—). NTIS, PC A19/MF A01. File Number DE84003020.

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

Separate abstracts were prepared for 49 papers in this proceedings. (LEW)

46370 (DOE/ER/10916—1, pp 1-8) **Simulation of turbulent shear flows at Stanford and NASA-AMES; what can we do and what have we learned.** Reynolds, W.C. (Stanford Univ., CA). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

This paper presents an overview of an extensive program of research in turbulent flow simulations, carried out starting in the early 1970s by a group at Stanford University in collaboration with colleagues at the NASA-Ames Research Center. This work is supported by NASA, which has made its extensive computing resources available for this work, and by the NSF.

46371 (DOE/ER/10916—1, pp 9-14) **Turbulent shear flows behind two-dimensional obstacles placed on plane boundary.** Okamoto, S. (Shibaura Inst. of Tech., Tokyo, Japan). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

This paper describes the experimental study of the shear flows behind two-dimensional obstacles placed on the plane boundary to examine the feasibility of artificially thickening a turbulent boundary layer on a flat plate. The obstacles used in this experiment were plates, square cylinder, and circular cylinder of size greater than the boundary-layer thickness at the setting position of the obstacle. The profiles of mean velocity, static pressure, and turbulent intensity of the shear flow were measured and discussed in comparison with those of a naturally developed turbulent boundary layer on the ground plate.

46372 (DOE/ER/10916—1, pp 15-20) **Development of turbulent boundary layer in open channel flows.** Yalin, M.S.; Karahan, E. (Queen's Univ., Kingston, Ontario). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

Laboratory measurements were carried out in order to determine how the velocity distributions are developing along a steady and turbulent open channel flow which can be treated as two-dimensional. Local time average velocities and the root-mean-square values of the longitudinal fluctuating velocities were measured: the measurements were carried out by means of a Laser Doppler anemometer. Two series of measurements were conducted: one for hydraulically smooth turbulent flows, the other for rough turbulent flows. The results obtained are analysed and discussed.

46373 (DOE/ER/10916—1, pp 21-33) **Turbulent kinetic energy balance in a conical diffuser.** Singh, D.; Azad, R.S. (Univ. of Manitoba, Winnipeg). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The present work evaluates the turbulent kinetic energy balance for a diffuser flow. The diffuser under study had a total included angle of 8° with an area ratio of 4:1 and was fed by fully developed pipe flow. Measurements of mean and fluctuating velocity correlations were taken by Arora (1978) using Pitot and static tubesand hot-wire anemometers. His results are used, in the present study, to examine the energy balance for diffuser flow. The general picture which emerges by integrating the turbulent energy terms over the cross-section area, reveals production and dissipation are of the same order. Similarly, mean flow convection and total transfer are of the same order. In the entry and intermediate regions (roughly from the inlet plane to 44 centimeters upstream from the exit plane) the average turbulent kinetic energy is increasing, and mean flow convection is balanced by convective diffusion due to pressure effects together with the difference of the production and dissipation. However, in the exit part of the diffuser, mean flow

convection is balanced by convective diffusion due to kinetic effects, and production balances the dissipation.

46374 (DOE/ER/10916—1, pp 34-42) **Strong adverse pressure gradient effects on supersonic turbulent boundary layer.** Lee, D.H.; Ardonceau, P.L. (Korea Advanced Inst. of Science and Tech., Seoul; Centre d'Etudes Aerodynaniques et Thermiques, Poitiers, France). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

Experimental measurements of supersonic turbulent boundary layer in shock wave-boundary layer interaction are analyzed. Using the Van Driest velocity transformation to account for the effects of compressibility, mean velocity profiles measured by LDV are shown to correlate in the classical composite wall-wake velocity profile. Values of the skin friction coefficient determined from the correlation described above are compared to values predicted by the Spalding-Chi correlation. To understand the effect of stepwise increase of pressure in the interaction, values of the wake strength parameter and Clauser's integral shape factor are also correlated with pressure gradient parameter, β/sub k/. This type of pressure incerease results in very high values of β/sub k/ that have never been reported in this type of supersonic turbulent boundary layer analysis. For these high values of β/sub k/, the values of wake strength parameter are comparable to the values, extrapolated to high β/sub k/ from low speed experimental data, and the values of Clauser's integral shape factor are slightly greater than the incompressible theory of Mellor and Gibson.

46375 (DOE/ER/10916—1, pp 43-53) **Effect of upstream boundary layer thickness upon flow past a backward-facing step.** Cheun, B.S.; Toy, N.; Moss, W.D. (Univ. of Surrey, Guildford, England). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The work described forms a part of a program of research into flow past square-edged shapes having the ultimate objective of yielding a better understanding of flows around structures in the natural wind. The particular study was concerned with a backward-facing step, concentrating on the effect of upstream conditions, namely boundary layer thickness and free-stream turbulence. The effect of the latter was felt, from a preliminary study, to be of relatively minor importance and attention was directed thereafter to the effect of boundary layer thickness, most particularly on the shear layer between the re-circulating region and the outer flow. In this main study, velocities and turbulent stresses were explored by hot-wire anemometers, both single- and crossed-wire, so yielding the line of the layer, its initial thickness and rate of growth and peak values of stresses. In the preliminary study, the pulsedwier anemometer was also used.

46376 (DOE/ER/10916—1, pp 54-63) **Turbulent wall jet issued from a Coanda nozzle.** Hatano. M. (National Defense Academy, Yokosuka, Japan). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

An experimental investigation on the steady incompressible turbulent plane wall jet of air injected from a specially designed small inclined flush slot type Coanda nozzle is performed at the injection Reynolds number 1.1×10^4. Static pressure, time-mean velocity and turbulence characteristics are obtained in detail by use of Pitot tube and hot-wire anemometer. It is confirmed that the jet injected from this nozzle flows around the corner attaching firmly on the wall surface without separation and forms the fully developed similar wall jet in downstream sections, even if there is no external flow.

46377 (DOE/ER/10916—1, pp 64-72) **Simultaneous measurement of velocity and temperature in flames using ldv and cw laser Rayleigh thermometry.** Dibble, R.W.; Rambach, G.D.; Hollenbach, R.E.; Ringland, J.T. (Sandia National Labs., Livermore, CA). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—). Contract AC04-76DP00789.

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

A technique for simultaneously measuring velocity and temperature in flames is demonstrated. In this technique a laser Doppler velocimeter shares a common probe volume with a cw laser Rayleigh thermometry system. A statistical theory is applied to describe the relationship between the number of simultaneous measurements made and the confidence of the velocity and temperature correlation. In addition to thermometry in flames, the technique can be applied to measure velocity and species concentration in isothermal variable density mixing flows.

46378 (DOE/ER/10916—1, pp 73-83) **Large eddy structure and turbulent mixing in flames.** Yule, A.J.; Ventura, J.M.P.; Chigier, N.A. (Univ. of Manchester, England; Univ. of Sheffield, England). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The structures of several premixed and partially premixed flames, with initially laminar conditions, are investigated. Fast response ionisation probes are used to measure intensities, spectra and cross-correlations of ionisation current fluctuations. Measurements provide information on the transition to turbulence in the first 20 burner nozzle diameters, as a function of initial conditions. Domination of the flows by large eddies is noted and the dependence of the fully turbulent flow structure on the initial transitional flow is discussed.

46379 (DOE/ER/10916—1, pp 84-91) **Pdf of temperature in recirculating flows.** Kollmann, W.; Schmitt, F. (Univ. of California, Davis; Univ. of Karlsruhe, Germany). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The closed equations for the pdf of a passive scalar, together with equations for mean velocity and two turbulence quantities, are applied to the prediction of a recirculating flow. The flow through a sudden expansion of a circular pipe is considered with temperature as passive scalar.

46380 (DOE/ER/10916—1, pp 92-98) **Turbulent mixing close to a wall.** Sullivan, P.J. (Univ. of Western Ontario, London). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The turbulent mixing of a contaminant cloud which is under the direct influence of a thin viscous-dominated or rough wall-layer adjacent to a solid (possibly chemically reactive or partially absorbing) surface is investigated. For this important but not well understood flow region a new and flexible model is proposed to describe the salient features of the wall layer in the turbulent mixing context.

46381 (DOE/ER/10916—1, pp 99-108) **Influence of basic physical processes on the statistical properties of dispersing heavy gas clouds.** Chatwin, P.C. (Univ. of Liverpool, England). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

There has recently been great interest in predicting the behavior of clouds of heavy gas formed by the sudden rupture of a container. Both experimental and theoretical studies have been made, and critical discussions of these are given, for example, by Havens (1977, 1979), Picknett (1978, 1981), McQuaid (1979) and Fay (1980). Nearly all theoretical studies so far made have attempted to predict the ensemble mean concentration of the gas, and have

ignored the deviations between this and the actual concentration, even though such deviations are of great significance in practically important problems such as assessing the likelihood of encountering flammability conditions downwind of a release of LNG. By contrast, the primary variable considered in the present paper is the probability density function of concentration, from which both the mean concentration and the fluctuation intensity can be derived and in terms of which predictions of many hazard probabilities can be made. The paper concentrates on the way basic physical processes influence the probability density function, with emphasis on the ambient atmospheric turbulence characteristics, including stability, the cloud's negative buoyancy and the role of molecular diffusion. Some simple forms of the probability density function are proposed and discussed, with particular attention being given to changes with time since release.

46382 (DOE/ER/10916—1, pp 109-119) **Analysis of turbulent heat transfer of solid-gas suspension flow in pipes.** Kim, J.W.; Choi, Y.D. (Korea Univ., Seoul). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

In order to investigate the turbulent heat transfer of solid-gas suspension flow in pipes, momentum equation and energy equation of suspension flow were solved numerically. Bulk motion of suspending particles was treated as the secondary gas flow with virtual density and viscosity. Mixing length models were extended to close the momentum equation and energy equation, and the applicability of mixing length models on the analysis of turbulent suspension flow was tested. Predictions of friction factors and Nusselt numbers with our turbulence models were in good agreement with available experimental data. Analytical results showed that relative particle diameter to pipe diameter, solid-gas loading ratio, and specific heat of suspending materials are the most important parameters which determined the turbulent heat transfer on suspension flow in pipes.

46383 (DOE/ER/10916—1, pp 120-128) **Microprocessor controlled data acquisition and processing system for hot-wire anemometry.** Laker, J.R.; Verriopoulos, C.A.; Vlachos, N.S. (Imperial Coll., London, England). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The advent of microprocessors and the improvement of digitization and data transfer techniques offers new advantages for the realization of cheap and efficient signal processing arrangements. This paper describes the hardware and software design of such a digital system for the statistical analysis of turbulence. It incorporates an APPLE II microprocessor, a 12-bit analogue-to-digital converter and a direct memory access controller allowing high sampling rates from a maximum of four channels. Hot-wire linearization, time averaging up to triple products, probability density distributions and power spectra are performed in the microcomputer. The power spectra are obtained using a machine language fast Fourier transform (FFT) algorithm and time-correlations are derived by similar inverse FFT techniques. Results are monitored via printout and graphics routines and are stored on a magnetic cartridge tape. The data may also be processed on a mainframe digital computer.

46384 (DOE/ER/10916—1, pp 129-138) **Turbulence-induced statistical bias in laser anemometry.** Erdmann, J.C.; Tropea, C. (Boeing Commercial Airplane Co., Seattle, WA; Univ. of Karlsruhe, Germany). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The bias of velocity histograms sampled by laser anemometry in turbulent flows has been experimentally investigated and theoretically analyzed. The test object was a confined backward-facing step water flow providing significantly different levels of turbulence. Velocity histograms were obtained at different mean particle rates using a transient recorder with computer as processor. The results show at low particle rates a strong bias that decreases monotonically to zero at high particle rates. The distribution of the waiting time for the next particle was determined and was used to calculate the probability density function of the sampled velocity and its expectation and variance. Three modes of operating an LDV processor are then recognized.

46385 (DOE/ER/10916—1, pp 139-148) **Minimization of farfield acoustic effects in turbulent boundary layer wall pressure fluctuation experiments.** Horne, M.P.; Hansen, R.J. (Naval Research Lab., Washington, DC). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

Experimental studies of turbulent boundary layer wall pressure fluctuations are typically complicated by facility generated acoustic pressure fluctuations which are superimposed on the turbulent fluctuations of interest. This problem can be particularly acute when the test fluid is water or other similar liquid with a high bulk wave propagation velocity. The present paper describes two methods for addressing this problem which together permit wall pressure fluctuation experiments of high quality to be conducted in pipe and annular flows of water over a bandwidth of 1 kHz. The first method is an improved technique for utilizing three flush mounted pressure transducers within a co-axial plane, providing more than 20 dB reduction without the use of electronic filters below 300 Hz. For frequencies above 300 Hz, where axisymmetric non-planar modes prevail, composite polymeric materials within the facility are shown to provide exceptional noise attenuation, reaching 60 dB at 1000 Hz. Experimental results show that the utilization of the two techniques allows measurement of both the nearfield and farfield pressure components. Excellent agreement with previously reported wall pressure fluctuation measurements is noted for the respective pipe flow geometries.

46386 (DOE/ER/10916—1, pp 149-160) **Effect of turbulence on static pressure probe responses: applications of old probes to new turbulence studies.** Becker, H.A.; Cho, S.H. (Queen's Univ., Kingston, Ontario). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

A theory of the effect of turbulence on the response of static pressure probes is given. In applying the theory to a given probe the response in a laminar stream must be known as a function of orientation. Numerical results are given for Prandtl probes. For these the effect of turbulence is negligible at the levels encountered in established pipe flows, but is highly significant at the levels prevailing in jets and other strongly turbulent systems.

46387 (DOE/ER/10916—1, pp 161-164) **In-stream static pressure sensor for atmospheric turbulence.** Jones, B.G.; Kim, C. (Univ. of Illinois, Urbana). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The bleed-type pressure transducer developed in our laboratory for measurement of instream static pressure has been adapted for atmospheric turbulence. The impetus for such adaptation derives from the general unavailability of pressure-velocity correlation data with which to check theoretical models of and turbulence kinetic energy balances in atmospheric boundary layers. Although our previous sensors have provided such data in relatively high speed, subsonic turbulent flows, the range of parameters in the atmospheric boundary layer dictates that substantial scaling changes be made to the earlier sensors. This paper discusses performance of a bleed-type sensor designed for the specific pressure amplitude fluctuation range and frequency response for atmospheric boundary layer applications.

46388 (DOE/ER/10916—1, pp 165-172) **Measurement of velocity-temperature correlations of different orders in hot turbulent flows.** Vallet, J.P.; Maye, J.P. (Laboratoire d'Etudes Aerodynamiques et Thermiques, Poitiers Cedex, France). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

In this paper, a experimental method is proposed for the measurement of second-order, as well as higher-order, velocity-temperature correlations in hot turbulent flows. This method uses both the classical technique of hot wire anemometry and recent developments in data acquisition and statistical numerical treatment. A number of results obtained in forced convection between two hot flat plates are presented here.

46389 (DOE/ER/10916—1, pp 173-180) **Frequency response of cold wires.** Browne, L.W.B.; Antonia, R.A. (Univ. of Newcastle, New South Wales, Australia). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The frequency response of a 0.63 μm cold wire is obtained with two different techniques and compared with the theory and other measurements reported in the literature. The discrepancy between theory and experiment and the discrepancy between different experiments may be due to the uncertainty in wire diameter, the age of the wire, and the particular technique used to determine the frequency response.

46390 (DOE/ER/10916—1, pp 181-191) **Effect of the thermal prong-wire interaction on the response of a cold wire in gaseous flows (air, argon and helium).** Lecordier, J.C.; Paranthoen, P.; Petit, C. (Centre National de la Recherche Scientifique, Mont Saint Aignan, France). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

Measurements of temperature fluctuations in slightly heated turbulent flows are usually performed with thin platinum wire resistance thermometers in order to obtain good frequency response and spatial resolution. However end conduction heat loss involves a step change in the frequency response at low frequencies due to the thermal inertia of prongs. In this paper a simple analysis of this phenomenon is presented taking into account the existence of transient thermal boundary layers around prongs by introducing the well-known cold length l/sub c/ and the broche length l/sub b/. Experimental investigation of this phenomenon is presented for several gases (air, helium, argon) and for several types of probes owing to a procedure which allows temperature fluctuations to be produced in a gaseous flow over a large range of frequencies. Experimental results show good agreement with analysis and indicate the influence of this effect on the measurement of intermittent temperature fluctions.

46391 (DOE/ER/10916—1, pp 192-201) **Hot-film anemometry in a two-phase (liquid metal-gas) medium.** Gherson, P.; Lykoudis, P.S. (Purdue Univ., West Lafayette, IN). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The feasibility of using the hot-film anemometric method to obtain information on the local two-phase flow pattern in a liquid metal-gas medium is reported. Differences were found between the hot-film sensor response to a gas bubble in water and the response to a similar bubble in mercury, mainly due to the different wetting properties of the two liquids. Measurements have been carried out in a mercury pool as well as in a vertical pipe flow regime. The processing of the anemometric signal included determining the local void fraction, local velocity and turbulent intensity of the liquid phase, as well as turbulence spectra and turbulent scales.

46392 (DOE/ER/10916—1, pp 202-207) **Use of hot-wire anemometer for low air speed measurement.** Podzimek, J.; Christman, P. (Univ. of Missouri, Rolla). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The measurement of air speeds below 20 cm s^{-1} is becoming a concern of physicists, chemists and engineers measuring the flow in pipes, in the boundary layer, in air motion over heated plates and in assessing the ventilation in homes and mine openings. Recently much emphasis has been put on the study of inhalation and respiration mechanisms and on the particle deposition in the respiratory tract of the human lung. Hot-wire anemometry - the origin of which goes back to the end of the last century - is a very sensitive method for low air speed and turbulence measurement. It is still competitive with the much more expensive laser anemometer and superior in special use such as measurement in highly polluted atmosphere. The aim of this contribution is to investigate the features of commercially produced hot-wire anemometers in a low airflow velocity regime and, using these data, to explain the meaning and potential limitations of individual terms in the equations of hot-wire anemometry if used for low air speeds.

46393 (DOE/ER/10916—1, pp 208-218) **Advanced techniques for transverse vorticity measurements.** Foss, J.F. (Michigan State Univ., East Lansing, MI). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

A four wire array of probes is used to determine the velocity components, their derivatives, and the transverse vorticity in a small (≃ 1 x 1 mm) spatial domain. The algorithms that define this calculation scheme and the extended considerations: compensating for minor calibration changes, uncertainty considerations, and the determination of excessive pitch angles in the data set, are presented.

46394 (DOE/ER/10916—1, pp 234-244) **Flow-visualization study of turbulent spots on solid and compliant surfaces.** Hoyt, J.W. (Rutgers Univ., New Brunswick, NJ). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

A water-table study of the formation of turbulent spots in laminar flow shows no difference in the production, appearance or other characteristics of spots flowing over either rigid or compliant surfaces. An indication of damping was obtained with compliant surfaces at very low Reynolds numbers.

46395 (DOE/ER/10916—1, pp 245-257) **Some flow visualization in presence of traveling waves on a compliant wall.** Arienti, R.; Nicoletti, G.; Giovanelli, R. (Univ. of Calabria, Arcavacata di Rende, Italy; Univ. of Parma, Italy). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The behavior of passive compliant walls with respect to the vorticity of the boundary layer has been oft investigated, but externally induced traveling waves along active compliant walls have been scarcely considered. In the present work two kinds of vibrational perturbations are examined. Both stabilization and de-stabilization effects were visualized and recorded by photographs and moving pictures. Some interesting qualitative results, and a few quantitative considerations are reported.

46396 (DOE/ER/10916—1, pp 258-264) **Numerical study of the analogy between wall heating and wall deformation.** Sakell, L.; Hansen, R.J. (Naval Research Lab., Washington, DC). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The suggestion has been made by T. Kubota (private communication) that local heating of a planar wall has an effect on a boundary layer analogous to a local wall deformation. The present paper examines the extent to which such an analogy exists by computing the response of a laminar boundary layer to thermal variations on a planar wall and deformations of a wall of constant temperature. The thermal and deformation fields considered vary peri-

odically in the flow direction but are independent of time and of the spanwise location. Results are presented for the resultant boundary layer displacement thickness distributions in air and water.

46397 (DOE/ER/10916—1, pp 265-277) **Polymer effects in fluid flow: proposed mechanism.** Durst, F.; Haas, R.; Interthal, W.; Keck, T. (Univ. of Karlsruhe, Germany; Hoechst AG, Frankfurt, Germany). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

Dilute, high molecular polymer solutions give rise to remarkable hydrodynamic effects, both in turbulent pipe flow and laminar porous media flow. The present paper proposes a basic mechanism leading to a general explanation as well for the increase of pressure drop in porous media flow as for the decrease in turbulent wall flow (drag reduction). These two effects are expected to be related to a marked stretching of the dissolved high polymers in elongational flow fields. In porous media flow the elongational flow character, caused by converging and diverging flow passages, can be described by the ratio of the superficial velocity to the bead diameter of the porous media. The elongational flow fields occurring in turbulence, e.g. produced between counterrotating pairs of eddies, are described in a similar way by the ratio of the root-mean square cross velocity to the length of the most energetic eddy. These descriptions lead to a satisfactory explanation of the observed non-Newtonian effects in both flow types, i.e. the onset behavior and the pressure drop changes.

46398 (DOE/ER/10916—1, pp 278-288) **Pattern recognition study of coherent motion in a transpired turbulent boundary layer.** Senda, M.; Suzuki, K. (Doshisha Univ., Kyoto, Japan; Kyoto Univ., Japan). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

Pattern recognition study has been made in a transpired turbulent boundary layer. Calming of ejection near the wall and intensification of sweep due to the effect of transpiration are discussed in connection with the u, v and uv patterns obtained. Some examination of the criteria used for the production of these patterns has been done.

46399 (DOE/ER/10916—1, pp 289-302) **Investigation of flow visualization techniques for detecting turbulent bursts.** Bogard, D.G.; Tiederman, W.G. (Purdue Univ., West Lafayette, IN). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

Bursting period measurements using flow visualization in a two dimensional water channel are presented. Simultaneous dye slot and hydrogen bubble flow visualization are used to indicate which flow events are being effectively marked by each technique. The experiments have shown what portion of the wall region is marked by a dye slot and the extent over which a single ejection can be detected near the wall. A new equation, based on the above results, is used to obtain average bursting periods at a point. Values for the bursting period from this equation are found to be independent of the dye slot width and to correspond well with the bursting period determined from hydrogen bubble flow visualization.

46400 (DOE/ER/10916—1, pp 303-310) **Vortex pairing in a Karman vortex street.** Matsui, T.; Okude, M. (Meijo Univ., Nagoya, Japan). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

Vortex pairing in a Karman vortex street behind a circular cylinder was investigated in a wind tunnel by flow visualization and hot wire technique. The secondary vortex street was formed with larger scale as the result of vortex pairing. The process of vortex pairing was studied in detail through flow visualization, wave forms and spectra of velocity fluctuations.

46401 (DOE/ER/10916—1, pp 311-321) **Smoke wire visualization of the external region of a two dimensional jet.** Moallemi, M.K.; Goldschmidt, V.W. (Purdue Univ., West Lafayette, IN). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

A smoke wire technique, such as described and detailed by Corke, Koga, Drubka, and Nagib (1977), A New Technique for Introducing Controlled Sheets of Smoke Streaklines in Wind Tunnels, was developed. With it, and simultaneous instantaneous photographs, the induced entraining flow field of a two-dimensional turbulent jet was studied. In addition, hot-wire/cold-wire measurements were taken to diagnose the flow direction. The flow visualization results revealed the existence of a considerable and measurable flow reversal near the edge of the jet. The results also disclosed that flow reversal is a direct consequence of passage of the large scale structures in the main region and their interaction with the entraining flow field. The flow reversal was quantified by hot-wire/cold-wire measurements. A measure of probability of the occurrence of flow reversal is now reported. The effects of different conditions governing the entrainment angle near the mouth of the jet are also reported. These different conditions were obtained by varying the inclination of the face plates.

46402 (DOE/ER/10916—1, pp 322-337) **Simultaneous steroscopic visual and anemometer measurements in a convected frame of reference.** Ghorashi, B.; Brodkey, R.S. (Cleveland State Univ., OH; Ohio State Univ., Columbus). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

In order to better understand the mechanism of turbulent shear flows through the study of coherent structures, an attempt was made to incorporate our previously developed convected stereoscopic visualization technique with a quantitative measure of the turbulence by the use of an x-configuration, hot-film probe also convected with the flow. The visualization was of particle motions in the flow with and without dye injection at the leading edge of the boundary layer. Of particular interest in the design was a mirror arrangement that allowed instantaneous combination of the visual resutls with the anemometry results on the film. The anemometer outputs were conditioned by an analog computer circuit so that the actual outputs were proportional to u, v, and uv, all on the same scale. In such a system, enumerable experimental difficulties were encountered that had to be overcome before satisfactory results could be obtained. Finally, a typical analysis of the resulting information will be given.

46403 (DOE/ER/10916—1, pp 338-349) **Three-component laser-Doppler anemometry measurements in a circular mixing tube.** Tay, S.N.; Denman, M.J.; Croft, D.R.; Williams, P.D. (General Electric Co. Power Engineering Ltd., Whetsone, England; Sheffield City Polytechnic, England). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

This paper presents the measurements of three orthogonal velocity componens in a circular mixing tube. A calculation procedure is devised to enable the position of the measuring point and the velocity to be determined from the geometry of the measuring system, considering the refractions taking place from air to perspex tube and from perspex tube to water. The techniques and limitations for measuring the highly turbulent liquid jet mixing and the results obtained are discussed.

46404 (DOE/ER/10916—1, pp 350-359) **3-D Laser Doppler Velocimeter for use in high-speed flows.** Yanta, W.J.; Ausherman, D.W. (Naval Surface Weapons Center, Silver Spring, MD). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The Laser Doppler Velocimeter (LDV) has become an important diagnostic tool for wind tunnel measurements. A three-dimensional LDV, capable of measuring both viscid and inviscid subsonic flowfields, has been in routine use at the Naval Surface Weapons Center for the past three years. The system basically uses three 1-D components in a non-orthogonal manner. Three components of velocity are measured and from the known geometry of the system, the velocity vector is computed. This paper will describe a 3-D LDV system which is capable of measuring the cross-flow component directly while still utilizing the nonorthogonal system. The Doppler frequency of the cross-flow component is obtained through appropriate electronic mixing and filtering of two other Doppler frequencies. Considerable detail will be given in describing the system. Also described in the paper will be some typical measurements of a three-dimensional boundary layer on a sharp cone at small angle of attack in a Mach-3 flow using the new system.

46405 (DOE/ER/10916—1, pp 360-369) **Three component velocity measurement in an open channel by a combination of LDA and hot film anemometry.** Mueller, A.; Studerus, X. (Federal Inst. of Tech., Zurich, Switzerland). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

In an open channel flow where secondary flow vortices were induced by longitudinal stripes of roughness, a method had to be devised for detecting the mean secondary flow, the Reynold's stresses and the turbulent flow structures. Axial and vertical components u(t) and v(t) were measured by LDA and u(t) and the lateral component w(t) were determined by a horizontally crossed hot film fiber probe. Calibration procedures and error estimates are presented. The limits of accuracy arise from the reduction of the velocity in the probe volume of the LDA due to the stagnation zone of the hot film probe. The fluctuations measured by the x-probe are biased as the probe is sensitive to the instantaneous gradients of u and w in the vertical direction. As u(t) is measured twice, the two methods can be compared in the time as well as in the frequency domain. Possible correction methods for mean quantities based on continuity and the periodicity of the flow in the lateral direction are discussed.

46406 (DOE/ER/10916—1, pp 370-379) **LDA investigations of turbulent mixing in a rod cluster.** Vonka, V.; Hoornstra, J.; Boersma, P. (Netherlands Energy Research Foundation ECN, Petten, Netherlands). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

A 2-channel tracker type laser Doppler anemometry set-up together with a data acquisition system based on hybrid data reduction are described. A new technique has been developed for improving the measurement accuracy of time averaged velocity measurements in stationary turbulent flows. It is shown that using this technique accurate measurement of small velocity gradients is possible. The improved accuracy has been used to determine the eddy viscosity coefficients of the lateral diffusive turbulent mixing in a rod cluster geometry and to measure the convective mixing due to the secondary flow components in square channels. An attempt to detect the theoretically predicted secondary vortices in a cluster geometry has been made and is discussed.

46407 (DOE/ER/10916—1, pp 380-389) **Space-correlation measurement of attaching jets by the new scanning Laser Doppler Velocimeter using a diffraction grating.** Nakatani, N.; Nishikawa, T.; Yoneda, Y.; Nakano, Y.; Yamada, T. (Osaka Univ., Suita, Japan). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

Recently we found that the wall-attachment fluidic element (Amp. 2) with parallel walls and diverging area in the main nozzle has shorter switching time than that of the element (Amp. 1) with parallel walls. In this study, to make the effect of turbulence, especially coherent structure, on the dynamic switching clear, the space-correlation coefficients of the attaching jets were measured by the use of the new developed LDV. In the LDV the diffraction gratings were used to vary the distance between a basic point and a reference point with high accuracy and on line in any direction. To reduce the ambiguity noise in auto-correlation term of denominator in space-correlation coefficient, signals from two frequency trackers at two points close to each other having the same velocity were correlated.

46408 (DOE/ER/10916—1, pp 390-400) **Turbulent spots.** Wygnanski, I. (Tel-Aviv Univ., Israel). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

There is an abundance of evidence that the fluid motion within the turbulent boundary layer is not as random as it was once believed, but contains large coherent eddies which may govern some important features of this flow. Although some characteristic behavior of these eddies was observed and charted, the information available to date is still mostly descriptive in nature. There are considerable difficulties in defining a detector which is capable of identifying large eddy structures unambiguously and impartially. Some difficulties are attributed to the fact that we are concerned with repeatable events occurring quite randomly in space and time. Furthermore, these structures are embedded in an environment containing a wide spectrum of finer scales. Another difficulty in charting the large eddy stems from the fact that a any instant of time it occupies a volume of fluid while most quantitative measuring devices provide information at a point.

46409 (DOE/ER/10916—1, pp 401-408) **Approach to estimating spectral energy transfer due to nonlinear interactions.** Miksad, R.W.; Jones, F.L.; Powers, E.J. (Univ. of Texas, Austin). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The generation of new fluctuations by nonlinear interactions during the transition of a two-dimensional wake is studied. Spectral energy transfers are estimated by using digital bispectral analysis techniques to determine coupling coefficients and power transfer functions.

46410 (DOE/ER/10916—1, pp 409-416) **Transition prediction based on a differential field theory of turbulence.** Pao, H.C.; Nee, V.W. (Univ. of Notre Dame, IN; Ford Motor Co., Dearborn, MI). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

The flow development in the transition region of a flat plate boundary layer is treated as an initial value problem. The governing system is closed with the incorporation of the Nee-Kovasznay theory as a simple turbulence model. Numerical calculations are performed to obtain the transition mean velocity profiles and transition characteristics.

46411 (DOE/ER/10916—1, pp 417-423) **Three dimensional disturbances propagated from a tunnel side wall to a mixing layer.** Tokimasa, T.; Nagase, Y. (Hiroshima Univ., Japan). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

Flow visualization and hot film-measurements were made in the transition region of a mixing layer. The structure of the two-dimensional vortex roll and the three-dimensional disturbance propagated from the duct side wall are presented. The physical nature of the disturbance in the side wall boundary layer is elucidated from the measurements.

46412 (DOE/ER/10916—1, pp 424-428) **Propagation of finite amplitude disturbances in the weakly non-parallel boundary layer.** Zimmermann, G. (MPI fuer Stroemungsforschung, Goettingen, Germany). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

Experimental findings suggest that neutral non-linear disturbances in the boundary layer at large Reynolds numbers propagate downstream essentially wave-like, with a weak additional modification due to viscosity. An appropriate expansion with respect to the Reynolds number renders in the lowest order a local equation, describing the possible local wave-shapes, and a propagation equation, describing the development of these local waveshapes over longer distances of propagation. Intermediate results show that the disturbances develop into an asymptotic state. It is suggested that the stability or instability properties of this asymptotic state is connected to the laminar-turbulent transition in the boundary layer.

46413 **(FEI—1418) Temperature field non-uniformities of a heat-radiated tube surface in the convective range. To the calculation technique.** Kapinos, G.A.; Remizov, O.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702948.

The dependence for calculating boundary of formation of conditions with nonuniformities of wall temperature for coolants of sub- and supercritical parameters was obtained according to temperature fields of tube wall in the convective range. Experiments were conducted for tubes with 12-24 mm inside diameter at 6-18 MPa pressures, 200-1000 Kg/m^2xs mass rates, 100-150 deg C water inlet temperature, for specific energy release 0-1000 kW/m^2 and (8-50)x10^3 inlet Reynolds number. Distributions of wall temperature along tube length during its electric heating were obtained. Experiments were conducted for vertical tubes at upstream water flow. 150 conditions with characteristic maximums of wall temperature along the tube length were analyzed. The suggested dependence uses Grashof, Nusselt, Reynolds, Prandtle criteria and describes experimental data aray with +-15% accuracy. The given technique enables to calculate such values as the length of heat exchange stabilization area and the minimum heat transfer without complete calculation of heat exchange along the whole tube length.

46414 **(IS-T—437) Liquid drop formation in the near-jet region.** Mahoney, D.P. (Ames Lab., IA (USA)). Feb 1971. Contract W-7405-ENG-82. 65p. NTIS, PC A04/MF A01; GPO Dep. File Number DE84016659.

Thesis. Submitted to Iowa State University.

Separating droplets of cyclohexane injected into water were photographed and analyzed to determine mean droplet separation time, interfacial area, volume, and rate of production of new droplet surface area as a function of nozzle Reynolds number. These measurements were made for three different nozzle diameters for both wetted and unwetted nozzles. The range of flowrates studied gave Reynolds numbers from a low of 100 to just less than 700, based on the nozzle diameter. An equation to predict droplet volume was developed by modifying the total force balance method of Scheele and Meister. This method correlated flow into the drop during the time between force equilibrium and physical droplet separation. The prediction held for both nozzle types, wetting and nonwetting. The mean deviation for the predicted droplet volume was 5.5%.

46415 **(LA—10021-MS) VORT: a computer code for bubbly two-phase flow.** Cook, T.L.; Harlow, F.H. (Los Alamos National Lab., NM (USA)). Jul 1984. Contract W-7405-ENG-36. 96p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017076.

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The VORT computer program has been developed for numerical solution of the time-varying dynamics of a two-field system. The current status of physical and mathematical modeling is presented in detail for a bubbly liquid. The report also contains a complete description of the numerical solution technique and a full description and listing of the computer program with instructions for its use. Application of the code to a von Karman vortex street is illustrated by two sample calculations. Comparisons with experimental observations are excellent.

46416 **Upstream flashing inception and critical flow: 11, effect of liquid compressibility.** Jones, O.C. Jr.; Shin, T.S. (Rensselaer Polytechnic Institute, Troy, NY 12181). *Transactions of the American Nuclear Society;* **46**: 855-857(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

46417 **The mean flow character of two-phase flow equations.** Trapp, J.A. (Univ. of Colorado at Denver, 1100 Fourteenth St., Denver, CO 80202). *Transactions of the American Nuclear Society;* **46**: 853(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

46418 **Experimental investigation of natural convection losses from open cavities.** Hess, C.F.; Henze, R.H. (Spectron Development Laboratories, Inc., Costa Mesa, California 92626). *Journal of Heat Transfer;* **106**: No. 2, 333-368(May 1984). Contract AC01-79ET21105.

Experimental results for natural convection in a cavity are reported. Both constrained andd unconstrained cavity geometries were studied. Detailed velocity profiles were obtained using Laser doppler velocimetry for Rayleigh numbers between 3 x 10^{10} and 2 x 10^{11}, corresponding to a constant elevated wall temperature boundary condition. Characteristics of two-dimensional and three-dimensional flows obtained with dye flow visualization are discussed, including boundary layer transition to turbulence, flow patterns in the cavity, and flow outside of the cavity. Local Nusselt number is correlated with local Rayleigh number for constrained and unconstrained cavities.

46419 **Recirculation of purged flow in an Adiabatic counterflow rotary dehumidifier.** Jurinak, J.J.; Mitchell, J.W. (University of Wisconsin, Solar Energy Laboratory, Madison, Wisconsin 53706). *Journal of Heat Transfer;* **106**: No. 2, 369-384(May 1984).

The average process stream outlet humidity ratio of an adiabatic counterflow dehumidifier can be lowered if a portion of the process outlet stream is purged from the bulk flow. The purged stream can be recirculated and introduced at the inlet of the regenerating period. In this paper, the performance of such a purged counterflow dehumidifier is studied. Two purge geometries that result in a spatially nonuniform inlet condition in the regenerating period are considered. Wave diagram solutions for the limiting case of infinite heat and mass transfer coefficients are used to qualitatively predict the behavior of the purged dehumidifier. A finite difference solution is used to verify the general trends of the approximate wave diagram solutions. The effect of the recirculated purge on the process stream outlet states of high performance silica gel dehumidifiers with low and high thermal capacitance matrices operated at nearly optimal rotational speeds is evaluated.

46420 **Effect of inclination of freezing in a sealed cylindrical capsule.** Larson, E.D.; Sparrow, E.M. (Department of Mechanical Engineering, University of Minnesota, Minneapolis, Minnesota 55455). *Journal of Heat Transfer;* **106**: No. 2, 394-406(May 1984).

Experiments were performed to study the heat transfer processes that occur during freezing inside of a sealed cylindrical capsule when the inclination of the capsule is varied parametrically from vertical to horizontal. The phase-change medium was 99 percent pure n-eicosane paraffin. It was found that the amount of mass that solidified during a given freezing period was insensitive to the inclination of the capsule, as was the amount of energy extracted from the capsule. Only highly localized quantities such as the local frozen layer thickness reflected the inclination of the cylinder. Parametric variations were also performed for the degree of subcooling of the capsule wall below the fusion temperature and for the degree of superheating of the liquid phase at the onset of freez-

ing. These variations facilitated the identification of the relative importance of the latent and sensible energies to the total extracted energy.

46421 **Flash evaporation from turbulent water jets.** Bharathan, D.; Penney, T. (Solar Energy Research Institute, Thermal Research Branch, Golden, Colorado 80401). *Journal of Heat Transfer;* **106**: No. 2, 407-424(May 1984).

Results of an experimental investigation of flash evaporation from turbulent planar and axisymmetric water jets are reported. In the range of jet thicknesses tested, for planar jets, due to shattering, evaporation if found to be nearly independent of the jet thickness. Evaporation from the planar jets was found to be dependent on the initial level of turbulence in the water supply manifold. An approximate analysis to model the evaporation process based on the physical phenomena and experimental observations is outlined. Comparisons between the experimental data and analytical predictions of the liquid temperature variation along the jet are included. Use of screens in the water jet are shown to be effective for enhancing evaporation.

46422 **Investigation of particle-laden turbulent flow in free shear turbulent combustion.** Buckingham, A.C.; Siekhaus, W.J.; Ellzey, J.; Daily, J.W. (Univ. of California, Berkeley). pp 1077-1086 of Numerical methods in laminar and turbulent flow. Swansea, Wales; Pineridge Press (1983). (CONF-830803—). Contract W-7405-ENG-48.

From 3. international conference on numerical methods in laminar and turbulent flow; Seattle, WA, USA (8 Aug 1983).

Two- and three-dimensional simulations and laboratory trials were performed to study particle-laden turbulent flows in free shear layers and within the boundary layer next to solid walls. Attention is focused on the dissipative effect of the particles on the carrier gas turbulent field and the predicted dispersal of particles under the random influence of the turbulent gas field, i.e., the mean and fluctuating components of the gas-particle forces. A first approximation of the velocity fluctuations and the mean flow components are calculated to satisfy a locally incompressible Poisson equation based on a pressure potential. The fluctuational velocity field of the vapor components and the forces on the particles were statistically decomposed, and the probability distribution integration was approximated through ensemble averaging for a finite summation of random samples. Determinations were made of the most-probable cluster trajectories, the particle aggregate cloud concentrations, and the spatial distributions. The results were compared with experimental data for premixed two-channel separated flows in a channel with a splitter plate. The results indicate that further development of the boundary conditions near the wall is required. 13 references.

46423 **Initial growth rate, population density, and cation content as limiting factors in the multiplication of nontransformed and transformed 3T3 cells.** Rubin, H. (Univ. of California, Berkeley). pp 33-45 of Biology of normal human growth. Ritzen, M. (ed.). New York, NY; Raven Press (1981). Contract AT03-79EV10277.

This bibliography contains 82 citations with abstracts, in the following categories: heat pipe general information, including conferences, reviews, and surveys; heat pipe theory; heat pipe design, development, fabrication; heat pipe testing and operation; and heat pipe applications in such areas as energy conversion and power, energy conservation, solar energy, nuclear energy, aerospace technology, and electrical applications.

4205 Materials Testing

REFER ALSO TO CITATION(S) 4205046218, 46516, 46533

46424 **(ACF—401-172) Photoelastic study of a metallurgical test specimen.** Fischer, M.A. (ACF Industries, Inc., Albuquerque, NM (USA)). 9 Aug 1963. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017612.

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A two-dimensional photoelastic study of a metallurgical test specimen is detailed. The results are scaled to the actual specimen, and presented in a parametric form. A discussion of the design of the specimen and loading fixture is included. Recommendations for the improvement of results of future studies are made.

46425 **(EPRI-CS—3511) Materials evaluation for fludized-bed combustion systems. Final report.** Minchener, A.J.; Sutcliffe, P.T.; Scott, I.S.; Courtney, R.S.; Lloyd, D.M.; Read,D.C.; Golesworthy, T.J.; Oakey, J.E. (National Coal Boərd, Stoke Orchard (UK). Coal Research Establishment). Aug 1984. 549p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920519.

This report outlines the results from four 250-hour tests designed to expand the knowledge base of corrosion mechanism in atmospheric fluidized-bed combustion. The work was carried out in the National Coal Board's 0.3-in.-square combustion test at Stoke Orchard, which is the same rig used for tests reported in EPRI CS-1475. Specific parameters or operating conditions investigated in these tests were the effects of substoichiometric combustion conditions, firing of volatile free char and high-chlorine coal, and the effects of metal temperatures for a range of alloys and steels. To support the testing objectives, special measurement capability for fluidized-bed, oxygen partial pressure, and tube metal temperatures was developed and successfully implemented. In addition to confirming previous observations on corrosion mechanisms, this work specifically showed the following: High-chlorine coal enhanced oxide scaling on lower-grade steels at metal temperatures of 500 to 600°C, yet did not affect oxidation rates of the more highly alloyed materials at high temperatures, and meaured oxygen activities in the bed were as low as 10^{-13} atmospheres and are likely located in the emulsion phase (in contrast to the bubble phase) of the bed.

46426 (INIS-mf—9040, pp 24-26) **Assessing corrosion of nuclear fuel waste containers.** McKay, P.; Nuttall, K.; Mitton, D.B. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

46427 (INIS-mf—9040, pp 31-35) **Preliminary evaluation of the design of particulate-packed, thin-wall container for disposal of irradiated fuel bundles.** Teper, B. (Ontario Hydro, Toronto (Canada)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

46428 (INIS-mf—9040, pp 36-39) **Effect of air contamination in the shielding gas on the mechanical properties Ti GTA welds.** Maak, P.Y.Y. (Ontario Hydro, Toronto (Canada)). 1982. NTIS (US Sales Only), PC A15/MF A01. File Number TI84780568. (CONF-820933—Summs.).

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

46429 **(LA-UR—84-2593) Characterization of fiber optic cables under large tensile loads.** Ogle, J.W.; Looney, L.D. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 10p. (CONF-840872—19). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016816.

From SPIE annual technical symposium; San Diego, CA, USA (19 Aug 1984).

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Fiber optic cables designed for the Nevada Test Site (NTS) have to withstand an unusually harsh environment. Cables have been manufactured under a 6 year old DOE specification that has been slightly modified as the cable requirements are better understood. In order to better understand the cable properties a unique capability has been established at the NTS. Instrumentation has been developed to characterize the transmission properties of 1 km of fiber optic cable placed under a controlled tensile load up to 1500 lbs. The properties measured are cable tension, cable elongation, induced attenuation, attenuation vs. location, fiber strain, bandwidth, and ambient temperature. Preforming these measure-

ments on cables from the two qualified NTS fiber optic cable manufacturers, Siecor and Andrew Corp., led to a new set of specifications. The relevant new and old specifications will be reported along with the characterization techniques and results on cables manufactured under the old specification.

46430 **(LA-UR—84-2741) Elastic wave propagation through polycrystals.** Gubernatis, J.E.; Maradudin, A.A. (Los Alamos National Lab., NM (USA); California Univ., Irvine (USA). Dept. of Physics). 1984. Contract W-7405-ENG-36. 8p. (CONF-840738—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016773.

From Progress in quantitative NDE; San Diego, CA, USA (8 Jul 1984).

Propagating elastic waves are commonly used to characterize nondestructively polycrystalline microstructure. To develop a fully quantitative characterization procedure, one needs a better understanding of what microstructural features most strongly influence the propagation and how these features appear in the measured, frequency dependent wave speed and attenuation. We report on our progress in a first principle investigation of these questions. We started with the equations of motion for elastic wave propagation and systematically developed a new approximation that is both well characterized and a potential improvement upon existing approximations. One of our objectives is studying the sensitivity of this approximation to changes in microstructural parameterization.

46431 **(ORNL/SUB—83-9062/1) Assessing expired fatigue life in large turbine shafts.** McClintock, F.A.; Nayeb-Hashemi, H.; Ritchie, R.O.; Wu, E.; Wood, W.T. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Mechanical Engineering). Jul 1984. Contract AC05-84OR21400. 143p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84016676.

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Rotating equipment, such as turbo-generator rotors used for automotive electrical power generator and transmission shafts, are often subjected to transient high-amplitude torsional oscillations that may severely limit the useful life of the structure through subcritical crack growth of undetected flaws. High strain amplitudes, approaching full-scale yielding of the shaft, can arise following electrical transients from particular line switching events in electric power generation and transmission systems. At such high torques, fatigue growth occurs in antiplane shear along transverse and/or longitudinal shear planes. The objective of this report is to provide an experimental and theoretical basis for characterizing antiplane shear fatigue crack growth under both small-scale yielding and elastic-plastic conditions in a low-strength, low-alloy steel. The approach combines continuum fracture mechanics and preliminary mechanistic modeling to serve as a framework for the development of defect-tolerant life estimation procedures for components loaded to high torques.

46432 **(PB—84-184183) Backscatter imaging tomography. Final report.** Stanley, J.H. (Advanced Research and Applications Corp., Sunnyvale, CA (USA)). May 1982. 92p. NTIS, PC A05/MF A01.

Results are presented of a feasibility study of a reconstructive imaging technique which relies upon a restorative algorithm to recover densitometric tomographs from measurements of the Compton-scattered radiation. Compton scattering and Compton cross sections are explained, and a configuration exhibiting the essential elements of an apparatus suitable for backscatter imaging tomography (BIT) is revealed. It is concluded that BIT offers considerable promise as a new inspection modality. The primary advantages of the technique are compactness, portability, and compatibility with in-service or in-process inspections. In addition, the examiner is allowed to quantitatively determine digital images of the subsurface structure of an object, thereby locating, sizing, and characterizing internal defects with accuracy.

46433 **Materials of construction.** Ellingson, W.A.; Natesan, K.; Vojnovich, T. (Argonne National Lab., Argonne, IL). pp 489-610 of The science and technology of coal and coal utilization. Cooper, B.R. New York, NY; Plenum Press (1984).

This chapter describes many generic areas of materials interactions in fossil energy systems as well as several specific application areas. A broad base of current information is presented on materials in the areas of gaseous corrosion of metals and refractories, slag corrosion of refractories, erosive wear of metals and ceramics, materials-design interface considerations, and nondestructive inspection. Topics considered include low-temperature corrosion (aqueous corrosion, stress corrosion cracking, steam corrosion, hydrogen attack), high-temperature corrosion (gaseous corrosion, molten salt corrosion, deposit-induced corrosion), erosion by solid particles entrained in gas streams, fluid mechanics, slurry erosion, cavitation erosion, mechanical properties (tensile properties, creep and creep-rupture properties, impact properties, low-cycle fatigue, stress-corrosion cracking), pressure vessels, refractory linings, heat exchangers, turbines, pressure vessel inspection, refractory lining inspection, steam boiler and heat exchanger inspection, and monitoring methods. Significant research has been conducted on the selection of alloys for pressure vessel applications and electrode materials for magnetohydrodynamics (MHD).

4206 Safety Engineering

REFER ALSO TO CITATION(S) 42060046349

4207 Vacuum Engineering

46434 **Multiple sample transfer device for use with surface analytical systems.** Nelson, G.C.; Shapnek, L.R. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **2**: No. 3, 1395-1396(Jul 1984). Contract AC04-76DP00789.

This note describes a sample transfer system that has been designed with a modified sample carousel for use with a Physical Electronics model 15-600 specimen stage. This system allows all of the twelve positions on the sample carousel to be used. It has been built using commercially available parts at a nominal cost. (AIP)

46435 **(LA-tr—84-38) Titanium sorption superhigh vacuum unit.** Kuz'min, A.A.; Zhilnin, V.S.; Men'shikov, M.I. Translated from *Pribory i Tekhnika Eksperimenta ;* No. 5, 166-168(1968). Contract W-7405-ENG-36. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017188. DE84017188

The design of a superhigh vacuum unit based on a titanium sorption pump with direct heated solid phase titanium evaporators made of Ti + Mo alloy is described. The maximum vacuum is better than 10^{-10} torr. The evacuation rate is 1100 to 1200 l/s.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 42080046255, 46534, 47042

46436 **(CONF-8408103—1) Strategy planning by an intelligent machine.** Weisbin, C.R.; de Saussure, G.; Barhen, J.; Swift, T.E.; White, J.C. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016609.

From 1. world conference on robotics research; Bethlehem, PA, USA (14 Aug 1984).

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The Center for Engineering Systems Advanced Research (CESAR) has recently been established at the Oak Ridge National Laboratory (ORNL) to address long-range, energy-related research in intelligent control systems. The purpose of this paper is to describe our initial investigations in developing efficient strategies to be used by an autonomous robot with hierarchical control structure operating in an unstructured, real-world environment. This research is an integral part of a system with complementary efforts in mathematical modeling, real-time control, sensor integration, etc. Our current work builds upon traditional areas of strength in artificial intelligence (i.e., knowledge representation, inferential reasoning,

and parallel planning) through the application requirements of real-time decision making and on-line learning.

46437 **(CONF-8408103—2) Parallel algorithms for robot dynamics.** Barhen, J.; Babcock, S.M. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016563.

From 1. world conference on robotics research; Bethlehem, PA, USA (14 Aug 1984).

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The Department of Energy recently established a Center for Engineering Systems Advanced Research (CESAR) at the Oak Ridge National Laboratory (ORNL). The Center's charter is to conduct long-range energy-related research in intelligent control systems. This paper reports initial results in developing parallel algorithms for efficiency enhancement in real-time solutions of manipulator dynamics equations. Two approaches to the solution of the inverse dynamics problem are discussed. The first is concerned with the implementation of Newton-Euler equations in multiprocessor architecture with emphasis on asynchronous algorithms and interprocess communication. The alternative approach is based on an explicit state description of the manipulator dynamics, obtained using computer-assisted analytic simplifications of the symbolic Lagrange-Euler equations. Multicomputer and multiprocessor implementations are discussed. The construction of a compact knowledge-base in terms of associative memories is also suggested, to allow solutions of the inverse dynamics based on similarity. Future directions are also outlined. This research is an integral part of a large systems integration effort with complementary tasks in strategy planning, sensor fusion, etc.

46438 **(ERATL—84/30/1) Power factor controllers: their markets and performance. An assessment of the performance of power factor controllers, executive summary.** Bradford, M.; Leung, S.W. (ERA Technology Ltd., Leatherhead (UK)). 1984. 13p. (ERA—82-112). NTIS, PC $1,500.00.

The report presents an overview of three previously-issued detailed reports (namely ERA Reports 81-139 and 82-39 which give the full performance data and Report 81-140 which discusses likely applications of these controllers). The performances of representative samples of five different controllers are summarized, and overall conclusions are drawn.

46439 **(N—84-13405) Superconducting niobium thin film slow-wave structures.** Bautista, J.J.; Petty, S.M.; Allen, L.H. (Jet Propulsion Lab., Pasadena, CA (USA)). Nov 1983. 13p. NTIS, PC A08/MF A01.

A superconducting comb structure as a slow-wave element in a traveling-wave maser will significantly improve maser noise temperature and gain by reducing the insertion loss. The results of the insertion loss measurements of superconducting niobium slow-wave structures subjected to maser operating conditions at X-Band frequencies are presented.

46440 **(N—8423283) Technology of the radiation hardened MOS devices.** Dragan, M.; Draghici, I.; Sachelarie, D.; Sachelarie, M. (Foreign Technology Div., Wright-Patterson AFB, OH (USA)). Feb 1984. 19p. (AD-A—138995; FTD-ID(RS)T—0031-84). NTIS, PC A02/MF A01.

During technological processes such as ion doping, plasma corrosion or X-ray lithography, radiation effects can be harmful to MOS devices used in the space, military and nuclear industries. Silicon and silicon dioxide preparation for radiation resistant MOS devices is reviewed. To obtain the lowest possible threshold voltage (1-2 V of 1,000,000 rad) the following points are outlined: (1) the silicon must be of the (100) type (2) the optimum oxidation temperature should be between 850 to 1000 C, while the sintering temperature should be between 460 to 500 C (3) aluminum doping can be useful. Silicon, silicon dioxide and metallization preparation and subsequent treatments are presented to achieve a very low shift in the threshold voltage under neutron radiation of a 10 to 4th power rad (si) total dose.

46441 **(SAND—84-1749) User/programmer guide for UCMD 108 multi-vertex polyarc/path integrity verifier.** La-France, L.J. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1984. Contract AC04-76DP00789. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017173.

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This document describes and documents UCMD 108 Version 2.0 - an Applicon AGS/880-I User Command. The program finds zero length polyarc/path component instances, verifies the closure of polygons, and verifies that the segments of polyarc/path components are parallel to thier respective coordinate axes. The tests are performed on polyarcs and paths in the AGS view cube. The tests are optional.

4209 Waste Processing Plants And Equipment

46442 **(SAND—84-0200C) Gravel Bed Confinement Verification Program.** Sandoval, R.P.; Luna, R.E.; Taylor, J.M.; Grandjean, N.; Newton, G.J. (Sandia National Labs., Albuquerque, NM (USA); Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst.). 1984. Contract AC04-76DP00789;AC04-76EV01013. 6p. (CONF-8409125—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016169.

From International aerosol conference; Minneapolis, MN, USA (17 Sep 1984).

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The Gravel Bed Confinement Verification Program (GBCVP) was initiated in early 1982 to provide information on the ability of gravel bed structures to contain respirable-sized toxic aerosols produced in detonation of a high explosive device containing heavy metals. Earlier tests of the containment structure design during the 1950s were primarily concerned with the degree to which the structure reduced ground contamination by radioactive materials. However, those tests did not address the exposure to respirable material of persons nearby and at site boundaries which is the principal concern, under current radiation protection standards, of the hazard to man.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 42100045397, 45706, 46142, 46234, 46425

46443 **(ANL—84-47) Burner stabilized flames in fluids.** Kaper, H.G.; Leaf, G.K.; Matalon, M.; Matkowsky, B.J. (Argonne National Lab., IL (USA)). Jul 1984. Contract W-31-109-ENG-38. 53p. NTIS, PC A04/MF A01; GPO Dep. File Number DE84017429.

In this report it is shown that a burner placed in a combustible fluid can have a stabilizing effect on a plane flame. A mathematical model is derived in which the flame is modeled as a surface of discontinuity in the flow field. Jump conditions for the fluid variables, as well as an expression for the flame speed, are obtained from an asymptotic analysis of the detailed structure of the flame. The model is applied to investigate the linear stability of a plane flame. Stable behavior is shown to exist for certain regimes of the parameters: Lewis number, burner strength, heat release and inflow velocity.

46444 **(CONF-8203178—, pp 49-52) Gasification of biomass fuel of little particle size.** Schmaus, H. Jul 1982. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number TI84770366.

From 10. Salzburg economic inquiry; Salzburg, Austria (4 Mar 1982).

A biomass conversion plant applicable to gasification of solid biomass wastes of small particle size up to 30 mm square measure and water content up to 70% is described. Derived gas will be purified by separating tar and condensates which are postcombusted at ca. 900°C. The lowest power range available is 130 kW(e). The use in sewage treatment plants is suggested.

46445 **(DOE/MC/14129—1646) Atmosphere rig PFBC test results: test 16 and 17. Investigations into the use of Run-of-Mine coal.** Roberts, A.G. (National Coal Board, Leatherhead (UK). Coal Utilization Research Lab.). Feb 1984. Contract AC21-80MC14129. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84012009.

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Investigations with run-of-mine (ROM) coal have been carried out in a small high-pressure fluidized-bed combustor. The coal was 3/4 inch x 0 Pittsburgh No. 8, with a moisture content of 3 1/2%. The objective of the tests was to compare the performance (combustion efficiency, sulphur capture, NO/sub x/ emissions) with that obtained with dry, crushed coal. The coal was fed into the lower part of the fluidized bed using a system of pressurized screws. Apart from being pressurized, these screw feeders were conventional. The final injector screw was about 3 1/2 inches diameter, running at a high, constant (170 rpm) speed; i.e. it was operating substantially empty. The coal feed contained a number of large shale particles. The bed sampling systems indicated that a proportion of these (and also of large coal particles) circulated freely in the bed below the tube bank, and to some extent within the tube bank. There was a gradual segregation process, however, in which the large particles settled on to the distributor. These large particles were mostly removed between the sparges of the distributor, so that defluidization did not occur. If there had not been provision for removing these large particles, the bed would undoubtedly have defluidized within a few hours. Post-test inspection showed no sintering or agglomerations in the bed or on the coal nozzle/injector screw. However, some sintering of coal to form discrete lumps up to 1 1/2 inch in size occurred, possibly influenced by the size and swelling characteristics of the coal. These particles were too large to pass between the sparges. There were insufficient of them to build up to the air nozzle holes and affect fluidization. As expected, combustion efficiency was greater than 99% at a bed temperature of 1560°F. Sulphur retention was perhaps slightly lower than with crushed coal at the same conditions, although there were insufficient data to be sure of this point.

46446 **(PB—84-199371) Evaluation of the efficiency of industrial flares: test results. Final report Oct 80-Feb 84.** Pohl, J.H.; Payne, R.; Lee, J. (Energy and Environmental Research Corp., Irvine, CA (USA)). May 1984. 194p. NTIS, PC A09/MF A01.

The report gives results of Phases 3 and 4 of a four-phase research program to quantify emissions from, and efficiencies of, industrial flares. Phase 1 consisted of the experimental design; Phase 2, the design of the test facilities; Phase 3, development of the test facilities; and Phase 4, data collection and analysis. The combustion efficiency of large pilot-scale flares was measured. The flame structure and combustion efficiencies were correlated with operating conditions of the flare, the size of the flare head, and properties of the flared gases. The combustion efficiency was correlated with the ratio of heating value of the gas flared to the heating value required to maintain a stable flame, and was independent of the flame head size. In turn, the heating value required to maintain a stable flame was correlated with the reciprocal of an estimated flame temperature based on properties of the flared gas. The length of the flame, entrainment into the flame, and liftoff distances were also correlated, using combinations of the Richardson Number, jet theory, and properties of the flared gas.

4220 Underground Engineering

REFER ALSO TO CITATION(S) 42200045381, 45382, 45383, 46548, 46788

46447 **(NP—4770365) Improvement of the mechanical properties of fine-grained unconsolidated rocks by gas injection.** Muellensiefen, K. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 30 Apr 1982. 124p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84770365.

It is reported about laboratory investigations to improve the mechanical properties of fine-grained loose rocks by the injection of silicon tetrafluoride and to increase the radius of operation in case of the in-situ application. Short-term as well as long-term strengths of the injected sample materials were determined. The best results were found with loose rocks with hydraulical permeabilities of $k=10^{-4}$ to $7x10^{-8}$ m/s.

46448 **(NP—4770379) Development of a low friction continuous conveyor for the mining region in coal mining which supports the air refrigeration.** Koerber, W. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 13 Jul 1982. 132p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84770379.

The icing of the parts of a scraper chain conveyor serving as gliding planes was studied for the purpose of decreasing the internal frictional resistances at scraper chain conveyors. It was found that the frictional coefficients between the loaded chain belt and the ice depend on the ice temperature, the pulling velocity and the load. An ice containing a mixture of plastic material as an additive has proven the most suitable due to its hardness and sufficient toughness. The cooling effect of an iced conveyor was found to correspond to such of a common air refrigerator according to a calculated operational example.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 42400045366, 45367

46449 **(LA-UR—84-2531) Intermediate results of a one-year study of a laser spectrometer in the DOE filter test facilities.** Soderholm, S.C.; Tillery, M.I. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 16p. (CONF-840806—10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016478.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

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A 1-year study of the model LAS-X (Particle Measuring Systems, Inc.) laser spectrometer in the Department of Energy (DOE) Filter Test Facilities (FTFs) was begun on August 1, 1983. The principal objectives of the study were to gain operational experience with the LAS-X/diluter/HP-85 particle size measurement system in the FTF environment, acquire size distribution data to quantify the consistency of the Q107 aerosol size distribution at each FTF and among FTFs, and compare the FTF test aerosols to current and proposed standards. Results of the first 9 months of the study are summarized and discussed. Major conclusions based on these data are: (1) the LAS-X system can be operated successfully in the FTF environment, (2) each FTF would require a back-up LAS-X to be able to continue filter testing during the (at least) once each year removal of a LAS-X from service for major recalibration and repair, (3) the FTF test aerosols are not monodisperse, as assumed in the military standard MIL-STD-282, and do not all meet the new DOE Nuclear Standard NE-F-3-43, which a replacement aerosol would be required to meet, (4) the test aerosol at each FTF is quite consistent over time, and (5) the test aerosols at the three FTFs differ consistently. Final conclusions and recommendations from this study will be developed after analysis of the full 12 months of data.

4250 Power Cycles

REFER ALSO TO CITATION(S) 42500045898

46450 **(N—84-15555) Analysis of a high-frequency Stirling Cycle compressor for cryogenic cooling in space.** Deshpande, M.D.; Studer, P.A. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Jul 1983. 110p. (NASA-TM—85066). NTIS, PC A06/MF A01.

The dynamics of a compressor piston with a nonlinear gas spring (provided by the gas compression force) operating in a self resonant mode were analyzed to permit computer simulation. The intent was to increase the operating frequency to 270 Hz and to design a dynamically balanced compressor. These changes, which

would allow greater specific power and eliminate a separate balancing device, are highly advantageous for cryogenic cooling in space. A short stroke large area piston allows a drive system to use electromagnetically coupled pistons with stationary excitation coils. This configuration and some test results are included. The performance of the drive system was studied analytically and computationally for operation under resonance conditions necessary for high efficiency. An acoustically tuned displacer is assumed. The analysis and computer model that was developed should allow optimization and miniaturization.

43 PARTICLE ACCELERATORS

46451 (INIS-SU—248) General nuclear physics. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1983. 78p. (CONF-8211171—). NTIS (US Sales Only), PC A05/MF A01. File Number DE84780608.

From 7. inter-branch meeting on the sharing of experience in the management and improvement of electrostatic accelerators; Obninsk, USSR (23 Nov 1982).

Papers presented were entered into the data base separately. (WHK)

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 43010046506

46452 (AECL—7840) Canadian accelerator breeder system development. Schriber, S.O. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Nov 1982. 30p. (CONF-820688—4). NTIS (US Sales Only), PC A03/MF A01. File Number DE84702968.

From EPRI symposium on accelerator breeder technology; Palo Alto, CA, USA (9 Jun 1982).

A shortage of fissile material at a reasonable price is expected to occur in the early part of the twenty-first century. Converting fertile material to fissile material by electronuclar methods is an option that can extend th world's resources of fissionable material, supplying fuel for nuclear power stations. This paper presents the rationale for electronuclear breeders and describes the Canadian development program for an accelerator breeder facility that could produce 1 Mg of fissile material per year.

46453 (INIS-SU—248, pp 59-64) **Some questions of the technique of high-voltage testing of accelerating tube space in electrostatic accelerators.** Romanov, V.A.; Ivanov, V.V.; Mukhametshin, V.I.; Dmitriev, E.P.; Kidalov, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. (In Russian). NTIS (US Sales Only), PC A05/MF A01. File Number TI84780608. (CONF-8211171—).

From 7. inter-branch meeting on the sharing of experience in the management and improvement of electrostatic accelerators; Obninsk, USSR (23 Nov 1982).

In the course of high-voltage testing of accelerating spaces a wide spread of experimental values of electric strength is observed. This circumstance is determined by a number of factors one of which is the technique used for high-voltage testing. For the purpose of obtaining more reliable experimental data on electric strength of accelerating spaces, it is suggested to take for a criterion of electric strength of an accelerating space in long accelerating tubes a long-time withstood voltage which is equal, approximately, to a doubled working space voltage obtained as a result of a smooth voltage rise at dark current density not exceeding $(1...5)\times10^{-3}$ A/cm^2. In the course of testing of accelerating spaces of 25 mm height with total working area of electrodes approximately 360 cm^2 and insulator area onto vacuum approximately 150 cm^2 a long-time 70 kV voltage with dark current less than 1.10^{-8} A is obtained.

46454 (INIS-SU—248, pp 9-12) **Complex of electrostatic accelerators for simulation and diagnostics of radiation damage.** Antuf'ev, Yu.P.; Belyaev, V.Kh.; Vergunov, A.D. 1983. (In Russian). NTIS (US Sales Only), PC A05/MF A01. File Number TI84780608. (CONF-8211171—).

From 7. inter-branch meeting on the sharing of experience in the management and improvement of electrostatic accelerators; Obninsk, USSR (23 Nov 1982).

The installation for simulation and diagnostics of radiation damage of materials is described. The installation consists of two electrostatic accelerators of vertical type for 5 MV and horizontal type for 800 kV. The accelerating complex ensures accelerated ion beam production in the independent operation regime as well as in the two beams target simultaneous irradiation regime, energy range of accelerated single-charged ions is 80 keV ... 5 MeV, homogeneity is better than +-0.05%. Oilless vacuum pumping out system is realized at the accelerating complex.

46455 (JINR—8-83-702) Specific features of the cryogenic system for an accelerator with superconducting magnets immensed into boiling helium. Agapov, N.N.; Sukhanova, A.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702961.

Specific features of the cryogenic system for an accelerator with a superconducting magnets immersed into boiling helium are considered. It is shown that the liquid helium level can significantly vary along the system. This is due to a hydraulic resistance of the removed vapour. An equation for calculating the level of liquid helium and results of its numerical integration are presented. It is shown that the effect of the level varying can be decreased by dividing the total perimeter of the accelerator into parts. This effect becomes stronger with temperature decreasing. Special features of calculation of safety devices are analysed. It is shown that action is of importance for such a calculation. This process leads to the liquid helium level increase, and, as a consequence, to a partial or full closing of vapour passage.

46456 (JINR—13-83-861) KUTI-20 adgezator cooling system. Dege, K.; Mironov, V.I.; Skitin, V.V.; Shcheulin, A.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1983. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702960.

The cooling system of the collective heavy ion accelerator KUTI-20 adgezator is described. The system has two closed water and oil loops. The transformer oil, cooling the magnetic system coils, at the same time fulfils the role of the insulation between windings. The use in the oil loop head and evacuating pumps permits to carry out cooling of the vacuum chamber with pressure to its walls smaller than 0.1 atm. The planned heat removal 200 kW as the result of cooling system configuration optimization is obtained. It is shown that the use of vortex generators and of separation discs in heat exchangers increases heat removal to 25%.

46457 (N—8424336) Linear induction accelerator. Bosamykin, V.S.; Pavlovskiy, A.I. (Foreign Technology Div., Wright-Patterson AFB, OH (USA)). Mar 1984. 6p. (AD-A—139458; FTD-ID(RS)T—1821-83). NTIS, PC A02/MF A01.

A linear induction accelerator of charged particles, containing inductors and an acceleration circuit, characterized by the fact that, for the purpose of increasing the power of the accelerator, each inductor is made in the form of a toroidal line with distributed parameters, from one end of which in the gap of the line a ring commutator is included, and from the other end of the ine a resistor is hooked up, is described.

46458 (RI—157) History of creation and pre-war years of the Radium Institute cyclotron. Part 1. Alkhazov, D.G.; Shilov, V.P.; Ehjsmont, V.P. (Radievyj Inst., Leningrad (USSR)). 1982. 32p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE84702967.

This paper deals with the history of creation and development in pre-war years of Radium Institute cyclotron - the first magnetic resonance accelerator made in Europe. The paper has been based on the materials of historical archives of V. G. Khlopin Radium Institute, literary writings and personal memories of one of the authors. This publication is dedicated to 45-th anniversary of

putting the cyclotron in operation and to 60-th anniversary of the Institute.

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 4302046496, 46503

46459 **(BNL—51764) Beam model for non-planar orbits in synchrotrons.** Month, M. (Brookhaven National Lab., Upton, NY (USA)). 26 Mar 1984. Contract AC02-76CH00016. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84016954.

A framework has been developed for a beam model in the case of synchrotron orbits not confined to a plane. An appropriate moving reference system for the analysis of beam stability has been introduced. As examples of strong perturbations to median plane symmetry, two geometries for the overpass for the Tevatron collider are considered.

46460 **(FNAL-TM—1277) Comparison of the second-order tune shift formulas due to sextupoles given by Collins and Ohnuma.** Ng, K.Y. (Fermi National Accelerator Lab., Batavia, IL (USA)). Aug 1984. Contract AC02-76CH03000. 3p. (CONF-8406155—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE84015639.

From 19. AIAA thermophysics conference; Snowmass, CO, USA (24 Jun 1984).

Recently, T. Collins put forth a theory of beam distortion and tune-shift due to sextupoles around the accelerator ring. He obtained formulas for the second-order tune shifts. In a contribution to the Conference on the Intersections between Particle and Nuclear Physics at Steamboat Springs, Ohnuma also computed the second-order tune-shifts due to sextupoles. He expanded the sextupole strength as harmonics around the ring and performed a canonical transformation so as to solve the equations of motion exactly up to first order in sextupole strength. These formulas appear to be quite different from those given by Collins. The purpose of this note is to show that they are in fact exactly the same.

46461 (INIS-SU—221, pp 91) **Method for charged particle beam longitudinal emittance measuring.** Tron', A.M.; Feshchenko, A.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. File Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

46462 **(JINR—9-83-554) Losses compensation at the synchrotron radiation of an electron ring moving periodically in the magnetic field.** Iovnovich, M.L.; Kuznetsov, A.B.; Rubin, N.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1983. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702963.

Electron ring oscillates in an inhomogeneous magnetic field. Electron synchrotron radiation leads to the decrease in electron energy and generalized azimuthal momentum. The loss compensation is performed by means of electromagnetic fields of two resonators one of which creates a longitudinal, and the other-azimuthal electric fields. Recurrent relations for changing the energy, electron longitudinal velocity and voltage phase of the resonators during ring oscillation are obtained. Parameters of electron equilibrium motion are found, and its stability is investigated. The region of equilibrium phase values is determined at which stable equilibrium motion is possible.

46463 **(JINR—E-9-83-608) Computer studies of the field for the superconducting magnetic system of the deuteron cyclotron DC-1.** Vorozhtsov, S.B.; Dudareva, T.N.; Zaplatin, N.L.; Samsonov, E.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 8p. (CONF-830971—10). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702953.

From 8. international conference on magnet technology and exhibition; Grenoble, France (5 Sep 1983).

The calculation results are presented concerning the magnetic system parameters for the 90 MeV deuteron cyclotron (DC-1). Dynamic characteristics of the equilibrium orbits have been calculated too. It is shown that stability of the circulation frequency in the 15-103 MeV energy range is maintained with the accuracy +- $2x10^{-3}$ or +-0.03 MHz. Calculations of the pondermotive forces affecting the coil showed that the maximum density of normal and axial forces equals 2.7 MN/m and 0.5 MN/m respectively.

46464 **(JINR—R-9-83-719) Orbit parameters in the central region of the JINR phasotron. Axial motion.** Vorozhtsov, S.B.; Shakun, N.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702955.

The investigation of the axial stability of the first turns in the JINR phasotron for various modes of operation is performed. The wave length of the axial envelope of the set particles was calculated in dynamical regime for comparison with the prescribed one. As a result, it was shown that there exists the sufficient axial focusing of the beam. For some mode of acceleration the requirements to the accuracy of magnetic field median plane shaping are found. The ways for decreasing of allowance for horizontal field component are designed.

46465 **(JINR—R-9-83-752) Effect of Self-fields on the acceleration of electron-ion ring in the KUTI-20 induction system.** Aleksakhin, Yu.I.; Kazacha, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702956.

The loading of inductors in the KUTI-20 induction accelerating system by the electron-ion ring; the energy losses of the ring due to the excitation of the currents in the quiding magnetic field coils and deceleration of the ring by image charges during its transition from the outlet pipe into the induction accelerating system, that is analogous to electrostatic stopping of electron beams are discussed. It is shown that the loading of inductors can be interpreted as discharge of the lines formed by primary windings of the adjacent inductors by return current induced by a moving ring. The mean value of the accelerating voltage decrease for KUTI-20 parameters is equal to approximately 16%. At the beginning of the acceleration the deceleration force, caused by the ring energy losses on the exitation of the quiding magnetic field coils is approximately 2% from the accelerating force and decreases inversely proportional to the ring velocity. The efficient deceleration force arising when ring moves from the outlet pipe into the accelerating system is 2.6 times smaller than its top permissible value and does not lead to separation of the ring components.

46466 **(JINR—R-11-83-724) Calculation of electromagnetic fields in periodical structures.** Kaschiev, M.S.; Puzynin, I.V.; Paramonov, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1983. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702954.

The problem for calculating the eigenfrequencies and electromagnetic fields in assymmetric periodical structures is formulated. Both the periodicity of structure and that of field are taken into account. A method for numerical solution of the obtained spectral problem is suggested. All calculations are made only on one section of structure. It permits to calculate dispersion characteristics of the structure containing an arbitrary number of periods, that was impossible in principle in earlier known formulations and methods for solution of this problem.

46467 **(LA—10150) Force balance limiting current for charged particle beams.** Kadish, A. (Los Alamos National Lab., NM (USA)). Jul 1984. Contract W-7405-ENG-36. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016976.

A limiting current for cold, relativistic, charged particle beams is derived. Arbitrary rotation and axial flow profiles are allowed. Only force balance is required. A comparison with the usual

Brillouin condition reveals a significantly more restrictive scaling for ambitious beam parameters. 6 references, 2 figures, 1 table.

46468 (SLAC-PUB—3412) Pulsed rf superconductivity program at SLAC. Campisi, I.E.; Farkas, Z.D. (Stanford Linear Accelerator Center, CA (USA)). Aug 1984. Contract AC03-76SF00515. 17p. (CONF-840790—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE84017193.

From 2. workshop on rf superconductivity; Geneva, Switzerland (23 Jul 1984).

Recent tests performed at SLAC on superconducting TM_{010} cavities using short rf pulses ($\leqq$ 2.5 μs) have established that at the cavity surface magnetic fields can be reached in the vicinity of the theoretical critical fields without an appreciable increase in average losses. Tests on niobium and lead cavities are reported. The pulse method seems to be best suited to study peak field properties of superconductors in the microwave band, without the limitations imposed by defects. The short pulses also seem to be more effective in decreasing the causes of field emission by rf processing. Applications of the pulsed rf superconductivity to high-gradient linear accelerators are also possible.

46469 (UCRL—90910) Current enhancement update. Chambers, F.W.; Clark, J.C.; Struve, K.W.; Yu, S.S. (Lawrence Livermore National Lab., CA (USA)). 14 Jun 1984. Contract W-7405-ENG-48. 9p. (CONF-8406133—14). NTIS, PC A02/MF A01; GPO Dep. File Number DE84017111.

From DARPA propagation meeting; Monterey, CA, USA (18 Jun 1984).

Net current enhancement to levels in excess of the beam current has been observed in gases at pressures excess of 50 torr. We delineate the regimes where enhancement is observed. The experimental results fall into two very distinct classes; current enhancement at injection where the beam is only slightly displaced and current enhancement clearly associated with the high amplitude hose instability. A careful theoretical and experimental study of the diagnostics revealed no fundamental flaws although there are several complex and unlikely scenarios which could introduce fictitious current enhancement. Theoretical efforts indicate several mechanisms for generating enhancement but none of the theories can account for the detailed observations. 4 references, 4 figures.

46470 (UCRL—90911) Emittance measurements on ETA and ATA. Chambers, F.W.; Prosnitz, D.; Fessenden, T.J. (Lawrence Livermore National Lab., CA (USA)). 14 Jun 1984. Contract W-7405-ENG-48. 8p. (CONF-8406133—16). NTIS, PC A02/MF A01; GPO Dep. File Number DE84017100.

From DARPA propagation meeting; Monterey, CA, USA (18 Jun 1984).

Emittance measurements on beams produced by the ETA and ATA accelerators are discussed. Emittance and brightness are defined. The significance of emittance for a beam in an accelerator and in gas is discussed. Various measurement techniques and results are presented and contrasted. Implicit calculations of emittance are also reported. Finally, the measurement of the time variation of emittance is discussed and the techniques to be used on the upcoming ATA experiments are outlined.

46471 (UCRL—90912) ATA diagnostic data handling system: an overview. Chambers, F.W.; Kallman, J.; McDonald, J.; Slominski, M. (Lawrence Livermore National Lab., CA (USA)). 14 Jun 1984. Contract W-7405-ENG-48. 7p. (CONF-8406133—15). NTIS, PC A02/MF A01; GPO Dep. File Number DE84017112.

From DARPA propagation meeting; Monterey, CA, USA (18 Jun 1984).

The functions to be performed by the ATA diagnostic data handling system are discussed. The capabilities of the present data acquisition system (System 0) are presented. The goals for the next generation acquisition system (System 1), currently under design, are discussed. Facilities on the Octopus system for data handling are reviewed. Finally, we discuss what has been learned about diagnostics and computer based data handling during the past year.

46472 (LA-tr—84-32) Preliminary grouping in a strong-current linear ion accelerator with a low injection energy. Enal'skii, V.A.; Osipov, V.V.; Fedotov, A.P.; Shembel, B.K. (Los Alamos National Lab., NM (USA); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). Aug 1984. Contract W-7405-ENG-36. Translation of IFVE-SKU-67-56-K, 1967. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017192.

The results of the numerical calculations show that, in strong-current accelerators with a low injection energy and a large increase in the velocity of the particles on the gaps: (1) the effect of the space charge, with grouping of the particles, may be weakened, to a considerable extent, by the utilization of large grouping voltages. In this case, the coefficient of grouping may exceed the corresponding values, given by the kinematic theory. (2) The spread of the velocities of the grouped particles, increased within certain limits, does not hinder the subsequent effective capture of the latter in a synchronous acceleration mode, because of the expanded region of capture, which is characteristic for a similar accelerator. (3) With small values of the generalized parameter of the space charge ($q \leqq 0.3$), one may, for calculation of the buncher, make use of the results of the kinematic theory with a known approximation. With values of $q > 0.5$, good results are provided by the theory of German and Kompaneets. In the intermediate range, for determination of the optimal drift length and the coefficient of grouping, it is necessary to utilize numerical methods of calculation. 9 references, 4 figures.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 43030046471, 46505, 46935, 46936

46473 (AECL—7912) Review of the MP tandem injector operation from 1967 to 1982. Imahori, Y. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Feb 1983. 35p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702969.

The CRNL MP Tandem Accelerator was shut down on 1982 May 7 to make the modifications necessary for combined operation of the Tandem Accelerator-Super Conducting Cyclotron (TASCC) Facility expected to start in 1983. Since the MP Tandem started operation in 1967 February, numerous technological improvements have been incorporated to make the accelerator operate more efficiently. This report reviews the past operation of the MP Tandem Injector and analyzes the reasons for shutdowns in order to facilitate more effective operation of the Negative Ion Injector for the new TASCC Facility.

46474 (INDC(NDS)—153/L) Survey of neutron energy spectra and angular distributions of the ^{9}Be(p,n)^{9}B reaction for fast neutron radiotherapy. Allab, M. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Mar 1984. 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702882.

Encouraging findings in radiobiology have stimulated a renewed use of fast neutrons in radiotherapy. The physical characteristics required for neutron beams to be suitable for radiotherapy are well established. As a result, the tendency is to replace the previous machines which generated the neutron beams from deuteron bombardment of thick targets (T, Li, Be) by hospital based cyclotrons which accelerate protons on thick beryllium targets. This report surveys the available experimental data of the ^{9}Be(p,n) reaction (cross sections, neutron spectra, yields, mean neutron energies) from the threshold to the proton energy Esub(p)=120 MeV and the works using this reaction in dosimetry measurements, with an emphasis on the data since 1977.

46475 (INIS-SU—221, pp 102) High-power ion beam generation in the AKVAGEN installation. Avrorov, A.P.; Astrelin, V.T.; Boyarintsev, Eh.L.; Kapitonov, V.A.; Koz'minykh, Yu.L.; Lagunov, V.M. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. File Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

46476 (INIS-SU—248, pp 65-68) **Electrical strength of vacuum gap at repetitive breakdown.** Dubinin, N.P.; Chistyakov, N.P. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1983. (In Russian). NTIS (US Sales Only), PC A05/MF A01. File Number TI84780608. (CONF-8211171—).

From 7. inter-branch meeting on the sharing of experience in the management and improvement of electrostatic accelerators; Obninsk, USSR (23 Nov 1982).

The investigation of repetitive pulse breakdown of vacuum space, which electrodes have been subjected to various treatment in vacuum and inert gas, is carried out. In case of electrode warm-up in vacuum up to 400 deg C as well as electronic heating up to 900 deg C the voltage in case of repetitive breakdown hasncreased approximately twice and in case of a through treatment, which is accomplished by a high-current glow discharge in inert gas, the maximum high voltage in case of the first breakdown at repetitive breakdown has decreased by 30...40%, remaining 2-3 times higher than in the first case.

46477 (INIS-SU—248, pp 48-50) **Some improvements in power and control systems for electrostatic accelerators.** Krivenkov, M.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. (In Russian). NTIS (US Sales Only), PC A05/MF A01. File Number TI84780608. (CONF-8211171—).

From 7. inter-branch meeting on the sharing of experience in the management and improvement of electrostatic accelerators; Obninsk, USSR (23 Nov 1982).

Descriptions and flowsheets of smooth start of electric motors of charging belts drive of electrostatic generators and power supply of the multiplying circuit and ion source system of cascade generator are shown. Circuit diagram of the test bed for the KEV-5 resistor training at 35 kV is presented. Flowsheets of units for sorbent drying directly in steel cylinders for accounting accelerator performance time for the experiment, and for indicating the state of the ion source high-frequency discharge plasma are described. The improved systems possess increased reliability, for the last 10-12 years no failures occurred.

46478 (INIS-SU—248, pp 35-38) **Injector of multicharged ions for electrostatic accelerators.** Kuz'menko, V.V.; Pistryak, V.M.; Simonenko, A.V.; Levchenko, Yu.Z. 1983. (In Russian). NTIS (US Sales Only), PC A05/MF A01. File Number TI84780608. (CONF-8211171—).

From 7. inter-branch meeting on the sharing of experience in the management and improvement of electrostatic accelerators; Obninsk, USSR (23 Nov 1982).

The construction and the results of preliminary tests of multicharged ions in ector, which can be situated inside the high-voltage electrode of the electrttic accelerator, are described. The injector consists of a multicharged ion source, beam shaping system and system of charge ions division. Injector characteristics are: length - 700 mm, maximum diameter - 250 mm, mass - 56 kg, total power consumption - 200 W. The outlet ion current injector obtained is Ar^{2+} approximately 30 μA, Ar^{3+} approximately 3 μA.

46479 (INIS-SU—248, pp 29-30) **Charging belt for electrostatic accelerators.** Klyuchnikov, A.A.; Linev, A.F.; Sakhno, V.I.; Totskij, Yu.I. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1983. (In Russian). NTIS (US Sales Only), PC A05/MF A01. File Number TI84780608. (CONF-8211171—).

From 7. inter-branch meeting on the sharing of experience in the management and improvement of electrostatic accelerators; Obninsk, USSR (23 Nov 1982).

The construction of the charging belt for electrostatic accelerators and electric motor control unit ensuring smooth speed-up and shut-down of the charging belt are described. Electrical insulators of the charging belt consist of a solid core (epoxide compound) and plastic shell with a low friction coefficient which increases the service life of the charging belt. The electric motor control unit is realized at semiconductor devices and in integral microcircuits and it can be switched into accelerator on-line control system.

46480 (INIS-SU—248, pp 27-28) **Accelerating tube with wide-aperture section for preliminary acceleration.** Romanov, V.A.; Ivanov, V.V.; Volodin, V.I.; Glotov, A.I.; Bazhal, S.V.; Kanaki, V.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. (In Russian). NTIS (US Sales Only), PC A05/MF A01. File Number TI84780608. (CONF-8211171—).

From 7. inter-branch meeting on the sharing of experience in the management and improvement of electrostatic accelerators; Obninsk, USSR (23 Nov 1982).

An improvement of the accelerating tube of the EG-1 accelerator is performed. Main attention is given to the system of accelerating tube matching with pulsed ion source. To decrease ion beam losses and ensure its stability upon acceleration, the length of the section for preliminary acceleration and electrode aperture are increased.

46481 (INIS-SU—248, pp 22-23) **Reconstruction of the electrostatic accelerator at the nuclear Physics Research Institute, Moscow University.** Almazov, A.V.; Dzagurov, O.; Krivolap, V.V.; Sirotinin, E.I.; Zhuravlev, G.N. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). 1983. (In Russian). NTIS (US Sales Only), PC A05/MF A01. File Number TI84780608. (CONF-8211171—).

From 7. inter-branch meeting on the sharing of experience in the management and improvement of electrostatic accelerators; Obninsk, USSR (23 Nov 1982).

The first stage of the reconstruction of the electrostatic accelerator at the Nuclear Physics Research Institute of Moscow State University is described. It consists of the following: the accelerating tube of improved electric resistance is mounted, a new voltage divider is mounted; band charge conveyer is substituted by induction charging unit, the stabilization a system with corona triode is introduce system.

46482 (ITEF—62(1983)) **Numerical calculations of the four, chamber H-resonator for an accelerator with spatially homogeneous quadrupolar focusing.** Lipkin, I.M.; Khapalov, S.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702952.

Results are discussed of numerical calculations of frequency and electromagnetic field of quadrupolar mode in a four-chamber H-resonator for a linear accelerator with spatially homogeneous quadrupolar focusing. The STRAUS program used in computations is described in brief. In the STRAUS program the Helmholtz equation is solved by the finite difference method using an orthogonal squaring. Discretization is carried out with a five-point pattern. The resulting set of linear equations is solved by the successive superrelaxation method with a double iterative process over the field and the wave number and with choosing an optimum superrelaxation parameter. From the analysis of the obtained data a conclusion is made that it is advisable to introduce tuning elements into the peripheral resonator area. The depth of frequency tuning can be 2.5%. Since the accuracy in frequency is 10^{-3}%, the electrode size tolerance can be $2x10^{-4}$% and the resonator radius tolerance - $6x10^{-4}$%.

46483 (JINR—9-83-711) **Design parameters of the IBR-30 installation after the modernization of the injector - an electron linear accelerator.** Rudenko, V.T.; Smirnov, V.L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1983. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702970.

The results of the modernization of the installation with the IBR-30 reactor used for time-of-flight nuclear-physical studies are discussed. The main parameters of the LVEh-40 accelerator the electron beam from which is used for irradiation of a target placed in thP reactor pile are given. ThP ways for the further installation efficiency increase are considered. The possibilities of further increase in efficiency are considered. It is shown that the use in the

SHF power supplying system the cavity resonators on standing waves for the pulse shortening and electron energy increase is promising. The methods of pulse frequency decrease at the same mean neutron intensity are elaborated for the time-of-flight low energy spectroscopy. After the modernization the efficiency of the neutron spectrometer will be increased in 20 times.

46484 **(JINR—9-83-772) Formation of pulse currents with a complicated law of variation in time in feed circuits of a collective accelerator compressor.** Barabash, L.S.; Sarantsev, V.P.; Timokhin, V.A.; Chalyshev, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1983. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702964.

Circuits of pulse feeding compressor coils of electron-ion rings which are used to obtain pulse currents with a complicated law of variation in time are considered. Some special features of operation of thyristor commutators in the circuits given are described.

46485 **(JINR—9-83-837) Trial operation of laser atomic source on KUTI-20 and PKUTI accelerators.** Mironov, V.E.; Shestakov, B.A.; Sil'nov, S.M.; Sotnichenko, E.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1983. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702965.

Schemes of ion loading of electron rings by using the laser atomic source, and its position in an adgezator chamber are described. Parameters of Pb atom fluxes, injected into electron ring, are presented. Detectors of bremsstrahlung, based on PELL and scintillator, were used for diagnostics of processes of ring loading with ions. KUTI-20 and PKUTI operated in the regime of ring compression up to about 3-4 cm radiUs, at ring electron number (5-7)x10^{13} at vacuum 2x10^{-8} Tor. The stability of ion loading of rings is registered experimentally. Control of loading process permits to draw a conclusion that its optimization and characteristics can be obtained. Trial operation of laser atomic source showed a high realisability of its performance.

46486 **(JINR—9-83-838) Some special properties of KUTI-20 adgezator power supply system.** Aleksandrov, V.S.; Bijskij, S.M.; Mironov, V.I.; Sarantsev, V.P.; Shcheulin, A.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1983. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702966.

Schemes of current formation in compression stage of KUTI-20 adgezator are considered. The possibility of obtaining pulsed magnetic fields suitable for ring compression under the condition of the essentially less energy, stored in the capacitors is experimentally confirmed. The analysis of the obtained results permits to proceed rationally to constructing power supply schemes for adgezator type installations.

46487 **(JINR—11-83-782) Calculation of electron beam source with a variable intensity.** Derendyaev, Yu.S.; Enchevich, I.B.; Mikhov, M.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1983. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702958.

Calculation on an electron beam source with a variable intensity of the current on the output is presented. Such beams are planned to be used at surface metal treatment (casehardening). The problem of analysis and synthesis of source electromagnetic system is computerized with the use of display. When analysis is performed in calculated electromagnetic fields due to electrodes and solenoid, equation of motion for electron emission was solved. The synthesis (the choice of source optimal parameters) was realized by numerical experiment. The form of electrodes, their potentials, which produce electron beams with a cross section of 3 mm^2 on output at 5A current have been found. It is shown that the variation of position of emitting e'ectrode or of deflecting electrode potential could change twice the current on the source output.

46488 **(JINR—13-83-478) Device for ion source synchronization.** Romanov, Yu.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702959.

Flowsheets, a brief description and main characteristics of the multichannel device for synchronization of the "KRION-1" source are presented. This ion source is placed on a high-voltage terminal. The main feature of this device is the use of optical fibre lines and the VT-340 display for control of time signals transferred to the ion source.

46489 **(JINR—R-9-83-817) Injection channel of the SPIN installation. Choice for construction and parameters.** Matyushevskij, E.A.; Shelaev, I.A.; Yudin, I.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702957.

Choice for parameters and construction of the injection channel of the SPIN-installation the JINR 1.5 GeV proton model supercondUcting synchrotron - are presented. The use of both "warm" (300 K) and "cold" (4.2 K) magnetic optical elements is provided for. The choice of parameters of the magnetic optical elements and their mounting in the injection channel is carried out taking into account phase volume matching of the beam injected and captured in the regime of accelerating the heavy ion beam. In order to diminish the beam final emittance one-turn regime of injection is proposed to apply in the SPIN synchrotron. At present the injection channel is at the stage of mounting.

46490 **(LA—10191-SR) Accelerator Technology Program. Status report, January-September 1983.** Jameson, R.A. (comp.). (Los Alamos National Lab., NM (USA)). Jul 1984. Contract W-7405-ENG-36. 90p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017083.

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This report presents highlights of major projects in the Accelerator Technology Division of the Los Alamos National Laboratory. The first section deals with the Fusion Materials Irradiation Test Facility's 2-MeV accelerator on which tests began in May, as scheduled. Then, activities are reported on beam dynamics, inertial fusion, structure development, the racetrack microtron, the CERN high-energy physics experiment NA-12, and LAMPF II. The Proton Storage Ring is discussed next, with emphasis on the computer control system, diagnostics interfacing, and theoretical support. Other sections summarize progress on a portable radiographic linac, developments on the klystron code, and on permanent magnets. Activities of the Theory and Simulation Group are outlined next, followed by discussion of the oscillator experiment and the energy-recovery experiment in the free electron laser project. The last section reports on the accelerator test stand. An unusual and very satisfying activity for the Division was the hosting of the 1983 Particle Accelerator Conference in Santa Fe, March 21-23, 1983. The conference had the largest attendance ever, with 895 registrants, 61 invited papers, and 521 contributed papers.

46491 **(SSRL—84/01) SSRL activity report for April 1, 1983-December 31, 1983.** Cantwell, K. (ed.). (Stanford Univ., CA (USA). Stanford Synchrotron Radiation Lab.). 1984. Contract AC03-82ER13000. 190p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE84017253.

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The report includes an overview, review of laboratory operations, machine physics studies, improvements to existing facilities, new beam lines and experimental stations, SSRL enhanced photon flux facility, planning for SSRL 6 GeV storage ring, Stanford x-ray radiation laboratory, future PEP synchrotron radiation sources, SSRL advisory panels and users conference, SSRL organization, experimental progress reports, theses based on research at SSRL, active proposals, and a list of publications based on work at SSRL. (GHT)

46492 **The remote replacement of a target cell at LAMPF.** Grisham, D.L.; Lambert, J.E. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **46**: 773-774(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

46493 **Remote handling of radioactive devices in the Fermilab target stations.** Eartly, D.; Currier, R.; Lindberg, J.; Sobczynski, S.; Stredde, H.; Strickland, W. (Fermi Nat'l Accelerator Laboratory, P.O. Box 500, Batavia, IL 60510). *Transactions of the American Nuclear Society;* **46**: 772-773(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

46494 **The status of the FMIT accelerator.** Kemp, E.L. (Los Alamos National Laboratory, Los Alamos, NM). pp 1321-1323 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

A 35-MeV, 100-mA cw linear accelerator is being designed by the Los Alamos National Laboratory for the Fusion Materials Irradiation Test Facility to be built at the Hanford Engineering Development Laboratory, Richland, Washington. The 2-MeV first section of the accelerator has been built at Los Alamos and is being evaluated. The initial performance of the 2-MeV system has been encouraging, although it has not operated cw at the required power level. The 2-MeV accelerator design is described and the performance test data are presented. The status of the future program is discussed.

4304 Storage Rings

46495 **(BNL—35173) Physics research opportunities with synchrotron x-radiation.** Moncton, D.E. (Brookhaven National Lab., Upton, NY (USA)). May 1984. Contract AC02-76CH00016. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016987.

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New x-ray sources of substantially increased brilliance would be available from undulator magnets operating on a new-generation 6 GeV storage ring. To understand what research opportunities would be provided by such improved sources, a number of existing x-ray scattering techniques are briefly described with a qualitative analysis of their requirements for source brilliance. In addition to improvements of existing techniques which will permit application to a generally broader range of problems, new opportunities for magnetic and inelastic x-ray scattering are discussed. 25 references, 15 figures.

46496 **(BNL—51734) Tune shifts for coasting beams crossing at small angles.** Parzen, G. (Brookhaven National Lab., Upton, NY (USA)). Nov 1983. Contract AC02-76CH00016. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017174.

Results are presented for the beam-beam nu-shifts for beams crossing at a small angle α. The beams are not round and have elliptic gaussian charge distributions. The conditions under which the results are valid are discussed. The results include long range effects, and effects of the cut-off of the beam-beam interaction. The theoretical results are compared with those obtained by numerical computation.

46497 **(SLAC/AP—30) Effect of reactive feedback on the transverse mode coupling instability.** Myers, S. (Stanford Linear Accelerator Center, CA (USA)). Aug 1984. Contract AC03-76SF00515. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017042.

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An important and realistic test to examine the effect of reactive feedback on the transverse mode coupling instability could be performed at PEP using the existing feedback system with some minor modifications. This test would of necessity take place at low energy and low synchrotron tune. Such an experiment is of great importance for the design of the LEP reactive feedback system and for the ultimate evaluation of LEP performance.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 44010045615, 45666, 46449, 46882, 46998

46498 **(DOE/EV/04957—4) In vivo detection, localization and measurement of radionuclides in man: a detection system for the localization and measurement of small amounts of photon emitters. Progress report, March 1, 1982-June 30, 1983.** Laurer, G.R. (New York Univ., NY (USA). Inst. of Environmental Medicine). 31 Jul 1983. Contract AC02-78EV04957. 162p. NTIS, PC AA08/MF A01; GPO Dep. File Number DE83015829.

The objective was the design, construction and testing of a photon detection system which will yield, simultaneously, information proportional to both the magnitude and the site(s) of deposition of radioactivity accidentally inhaled or ingested or otherwise deposited in the body. The operating principle of the detector system, active collimation, allows the resolution of the position and outline, in space, of the radioactive deposit, i.e., the image of the emitter(s), without the use of separate, external collimating devices. The result of this is an imaging detection system with a much higher counting efficiency than other currently available systems. 20 references, 29 figures.

46499 **(DOE/NV/00410—T3) Calibration system for albedo neutron dosimeters.** Rothermich, N.E. (San Diego State Univ., CA (USA)). 1981. Contract AC08-76NV00410. 57p. NTIS, PC A04/MF A01; GPO Dep. File Number DE84016689.

Thesis.

Albedo neutron dosimeters have proven to be effective as a method of measuring the dose from neutron exposures that other types of neutron detectors cannot measure. Results of research conducted to calibrate an albedo neutron dosemeter are presented. The calibration procedure consisted of exposing the TLD chips to a 46 curie ^{239}PuBe source at known distances, dose rates and exposure periods. The response of the TLD's is related to the dose rate measured with a dose rate meter to obtain the calibration factor. This calibration factor is then related to the ratio of the counting rates determined by 9-inch and 3-inch Bonner spheres (also called remmeters) and a calibration curve was determined. 17 references, 10 figures, 3 tables.

46500 **(ECN—153) Lecture notes on computerized neutron spectrometry.** Zijp, W.L. (SEE CODE- 4593600 Stichting Energieonderzoek Centrum Nederland, Petten). Mar 1984. 45p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702829.

After a general introduction on the various methods for neutron spectrometry, special attention is given to the neutron spectrum adjustment on the basis of measured activation and fission rates induced in activation (or fission) detectors. Recent methods are based on the least squares approach. Both the SAND-II method and the STAY'SL approach (based on the generalized least squares principle) are considered.

46501 **(FNAL-TM—1270) Calculation of transmission line impedances using the ANSYS finite element program.** Johnson, M.E. (Fermi National Accelerator Lab., Batavia, IL (USA)). 29 Jun 1984. Contract AC02-76CH03000. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016715.

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This paper describes numerical techniques for calculating the capacitance of an arbitrary two conductor structure. For two dimensional structures the capacitance per unit length can be easily related to the characteristic impedance of a transmission line with

the same cross section. Note that this is true for lines operated below their cut off frequency, i.e., TEM mode only. Thus, one can compute the impedance of an arbitrarily shaped line. The method using the ANSYS finite element program is being used to design the high voltage transmission line for the Yale streamer chamber. This line has a transition piece between two different cross sections. It is being modeled by taking several slices throughout the transition region.

46502 **(IAE—3533/14) 150 kJ, 5MA pulse current generator.** Matveev, V.V.; Prut, V.V.; Suslov, P.A.; Udalov, A.M.; Shibaev, S.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702950.

The 150 kJ pulse current generator designed for experiments in the field of fast process physics is described. The battery is assembled of KMKI 60-2 capacitors. The self generator inductance is 8 nH that provides pulse current up to 5 MA during operation for 5 nH low-inductance load. Current commutation is realized by three-electrode air spark gaps at 18-40 kV operating voltage. The spark gaps are ignited by a igniting pulse generator assembled on the base of a single shaping line with water insulation.

46503 **(IFVE-OUNK-OEA—82-204) Beam profile measurement during proton slow extraction from JHEP accelerator.** Elin, A.P.; Matyushin, A.A.; Merker, Eh.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702951.

Secondary emission beam monitor designed for extracted beam profile measurement has been developed. The aperture of the beam monitor is 50x50 mm, its length along the beam being 60 mm. Electrons knocked out from the 0.02 mm thick copper foil emitter under the effect of electric potential applied to the emitter drift along magnetic lines of force in the direction of collector electrodes. Electric charge measured from electrodes parallel to the beam axis gives the information on the beam radial distribution and the charge measured from the electrodes vertical to the beam axis gives the information on the beam transversal distribution. There are ten electrodes of 40 mm length for each coordinate. The width of radial collector electrodes is 1.5 mm, for vertical electrodes is 2 mm. The gap between electrodes is 0.5 mm. The developed beam monitor can operate in the presence of magnetic field, is simple in fabrication, its readings are weakly dependent on the effect of secondary particles knocked out by proton beam from current walls of septum magnets.

46504 (INIS-mf—9031, pp 281-290) **Interpretation of neutron physics characteristics measurements on diagnostic fuel assemblies.** Hrazdil, O. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A03/MF A01. File Number TI84780526. (CONF-8112102—Vol.4).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

The programme of measurement using a model of the diagnostic assembly was divided into four experiments. The aim of the first experiment with the DK-LR-0 assembly is to obtain a set of basic neutron-physical characteristics of the lattice in the diagnostic assembly without in-core instrumentation. The planned measurements are described. According to obtained results, the methods used for the three other experiments using in-core instruments will be specified. The aims of the experiments and problems which they are to resolve are presented. The results will be presented in form of correction factors. The possibility of determining correction factors for the correct interpretation of measurements with a miniature fission chamber, self-powered detector and microcalorimeters are presented. The common feature of the three other experiments is the determination of the change in neutron spectra in the neighbourhood of the detector.

46505 **(INIS-mf—9047) Trigger and data taking system of the MARK-J detector.** Ho, Meng-Chia. (Amsterdam Univ. (Netherlands)). 19 Oct 1983. 126p. NTIS (US Sales Only), PC A07/MF A01. File Number DE84780613.

The MARK-J detector utilizes PETRA, the world's highest energy electron-positron colliding beam storage ring now in operation. In this thesis, the PETRA machine and some of the details of the MARK-J detector are described. The detector which contains about 400 counters with photomultipliers for measuring electromagnetic and hadron showers, and approximately 8500 wires in the drift chambers to measure the muon trajectories, needs an elaborate trigger system. The fast electronic trigger of the experiment is described in detail. An important ingredient for the various triggers to collect the events of interest is formed by the so-called total energy trigger which is described as well. The various electronic components which form the interface between experiment and the online computer are described. Then the on-line system itself and the data collection programs are presented. In order to calibrate the various components of the detector, special measurements are performed, which are described. Finally this thesis ends with a presentation of some of the main results in Bhabha scattering, the measurement of the total hadronic cross section and the asymmetry measurement in muon pair production.

46506 (INIS-SU—248, pp 6-8) **Use of low-voltage accelerator for proton-induced X-ray emission analysis of solid surface layers.** Agafonova, V.A.; D'yachkov, B.A.; Pavlov, V.Ya. (AN SSSR, Chernogolovka. Inst. Fiziki Tverdogo Tela). 1983. (In Russian). NTIS (US Sales Only), PC A05/MF A01. File Number TI84780608. (CONF-8211171—).

From 7. inter-branch meeting on the sharing of experience in the management and improvement of electrostatic accelerators; Obninsk, USSR (23 Nov 1982).

A brief description of X-ray spectrometer for ion X-ray spectroscopy on a low-voltage accelerator base is given. The results of estimation of limits of elements detecting in a thick target by characteristic x radiation proton-induced at 175 keV are presented. The profile of distribution of phosphorus atoms implanted into monocrystalline germanium is measured by detecting characteristic x radiation of phosphorus K-line and consequent sample etching by xenon ion beam. The possibility of using low-voltage accelerator for proton-induced X-ray emission analysis of solid surface layers is shown.

46507 **(IRNE—155-1982) Conditions for high resolution in a three-axis curved-ideal-crystal neutron spectrometer.** Popovici, M.; Stoica, A.D. (Institutul Central de Fizica, Bucharest (Romania)). Sep 1982. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702833.

The neutron optics of three-axis spectrometers with curved ideal monochromator and analyser crystals is considered. The computation technique allows for both real-and reciprocal-space focusing effects. The possibility is revealed of obtaining very high resolutions based on the correlation between the monochromator and analyser units introduced by a thin sample with a suitable orientation. The energy transfer resolution can be brought up to that of the back-scattering spectrometer, with additional possibilities of obtaining high resolutions along any given direction in the Ω vector, ω space and of measuring large energy and momentum transfers while using initial energies at the maximum of the thermal neutron flux. The high resolution conditions can be satisfied by varying the curvature of the monochromator and analyser crystals and the sample orientation. Simple analytical relations are given for connecting the desired high-resolution direction in the Ω vector, ω space with necessary spectrometer geometry.

46508 **(JINR—9-83-305) Spectrametric set up on-line with the SM-3 computer for nuclear beam composition analysis at the LU-20 linear accelerator.** Avdejchikov, V.V.; Vasilishin, B.V.; Volkov, V.I.; Zinov'ev, L.P.; Kulikov, I.I.; Monchinskij, V.A.; Nomokonov, P.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702962.

The spectrometer for nuclear beam composition analysis at the output of Lu-20 linear accelerator is described. The spectrometer is a part of the synchrophasotron injector control system on-line with SM-3 computer. The method of analysis is based on the energy measurement of nuclei scattered on a thin gold foil. The semiconductor detector for nuclear registration is used. The electronic apparatus consists of the spectrometric instrumentation, an analog-to-digital converter with the buffer storage and the interfaces of information representation devices. The programs are written in the macroassembler language with the use of RT-11V02 operating system. The results in a histogram form are represented on a colour TV monitor and hard copies can be produced via a plotter and a printer.

46509 **(JINR—13-83-504) Technique of absolute efficiency determination for gamma radiation semiconductor detectors.** Vo Dak Bang; Chan Dyk Tkhiep; Chan Daj Ngiep; Fan Tkhu Khyong; Gehrbish, Sh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1983. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702949.

Simple technique is suggested to determine the absolute efficiency (E) of semiconductor detectors (SCD) which employs low-intensity neutron sources wide spread in scientific laboratories. The technique is based on using radioactive nuclide gamma radiation in decay chains of heavy element fission fragments, uranium-235, for example. Cumulative yields of a number of nulcides following heavy element fission are measured to a high accuracy (1-5%), the value E is determined for a wide energy range (from X- ray to some MeV); using a nuclide with a well known decay scheme and measured to a high accuracy cumulative yield ^{140}La, for example, one can calibrate in absolute values comparatively easily obtained plots of the SCD relative efficiency. The technique allows to determine the E value for extended plane (and volumetric) sources of an arbitrary form. Some nuclides, convenient for the determination of E, and their nuclear characteristics are tabulated.

46510 **(LA-UR—84-2594) 100 MHz fiber optic single transient gamma ray detection system.** Ogle, J.W.; Smith, R.C.; Ward, M.; Ramsey, R.; Hollabaugh, J. (Los Alamos National Lab., NM (USA); EG and G, Inc., Los Alamos, NM (USA)). 1984. Contract W-7405-ENG-36. 8p. (CONF-840872—18). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016818.

From SPIE annual technical symposium; San Diego, CA, USA (19 Aug 1984).

A fiber optic system has been developed to measure single transient gamma rays. The gamma ray signature is converted to light by the Cerenkov process in a 20 cm length of radiation resistant optical fiber. The signal is transmitted over 1 km of optical fiber and detected by state-of-the-art, 175 MHz analog receivers. The receivers are based on silicon PIN detectors with transimpedance hybrid amplifiers and two stages of power amplification. The dc coupled receivers have less than 2% distortion up to 5 volts with less than 10 mV rms noise and a responsivity of 37,500 V/watt at 800 nm. A calibration system measures relative fiber to fiber transit time delays and "system" sensitivity. System bandwidth measurements utilized an electron linear accelerator (Linac) with a 50 ps electron pulse as the Cerenkov light source. The system will be described with supporting calibrationa and characterization data of parts of the system and the whole system.

46511 **(RFP—3687) Health, Safety & Environment Laboratories project progress report, June-December 1983.** Smith, L.C.; Jameson, M.T.; Williams, W.F. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 10 Jul 1984. Contract AC04-76DP03533. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016003.

Brief summaries of progress achieved during the period from June through December 1983, are presented in each subject area. Subject titles are: Determination of uranium in urine by Laser Fluorimetry; Atomic Emission Scanning of Sample Matrices; Alpha Spectroscopy System Explosion; Alpha Spectroscopy Vacuum System Upgrade; Remote Monitoring of HS and E Data Acquisition Systems; Data Communications Link; Emergency Alpha System; Total Alpha-Beta Counting System; Automated Personnel Dosimetry System; Combination Hand and Foot Counter; Silicon Detector Alpha Particle Monitoring Detection System; Three Channel Smear Counter; Remote Controlled Radiation Re-entry System; Miniature Neutron Dosemeter; Die Cost Air Proportional Detector; and Self-Testing Neutron Criticality Alarm Detector.

46512 **(UCRL—90494) Developments of optical fast-gated imaging systems.** Koehler, H.A.; Kotecki, D. (Lawrence Livermore National Lab., CA (USA)). Aug 1984. Contract W-7405-ENG-48. 10p. (CONF-840887—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016170.

From 16. international congress on high speed photography and photonics; Strasbourg, France (27 Aug 1984).

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Several fast-gated imaging systems to measure ultra-fast single-transient data have been developed for time-resolved imaging of pulsed radiation sources. These systems were designed to achieve image recording times of 1 to 3 ms and dynamic ranges of >200:1 to produce large two-dimensional images ($\geqq 10^4$ spatial points) of 1 to 2 ns exposure and small two-dimensional images ($\leqq$ 200 spatial points) of $\leqq$ 0.5 ns exposure. Both MCP intensified solid-state two-dimensional framing cameras and streak camera/solid-state camera systems were used; the framing camera system provides snap shots with high spatial resolution whereas the streak camera system provides for limited spatial points each with high temporal resolution. Applications of these systems include electron-beam, x-ray, gamma-ray, and neutron diagnostics. This report reviews the characteristics of the major components of fast-gated imaging systems developed at Lawrence Livermore National Laboratory. System performances are described in view of major experiments, and the diagnostic requirements of new experiments in atomic physics (x-ray lasers) and nuclear physics (fusion) are indicated.

46513 **Evaluation of a charge-coupled device for high-energy particle detection.** Bhuiya, A.H. (Physics Department, Tufts University, Medford, Massachusetts 02155). *Journal of Applied Physics;* **56**: No. 8, 2362-2364(15 Oct 1984). Contract AC02-76ER03023.

A study has been made to evaluate the application of a charge-coupled device as a detector of minimum-ionizing, charged particles. The experiment was performed with a Fairchild CCD111, a linear array 256-element charge-coupled device. It is concluded that the CCD111 should be able to detect high-energy particles at low operating temperatures (~-75 °C) with exposure times of less than 10-ms duration. Finally, a speedy readout system is described for practical application in high-energy experiments.

46514 **Time domain optical spectrometry with fiber optic waveguides.** Whitten, W.B. (Oak Ridge National Lab., TN). *Applied Spectroscopy Reviews;* **19**: No. 3, 325-362(1983). Contract W-7405-ENG-26.

Spectrometers which use optical fibers to obtain time domain spectral dispersion are reviewed. Pulse transmission through fiber optic waveguides is discussed and the basic requirements for sources and detectors are given. Multiplex spectrometry and time-of-flight spectrometry are then discussed. Resolution, fiber requirements, instrumentation and specific spectrometers are presented.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

46515 **(LA-UR—84-2470) Transient attenuation in optical fibers.** Hopkins, A.A.; Kelly, R.E.; Looney, L.D.; Lyons, P.B. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 9p. (CONF-840872—20). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016487.

From SPIE annual technical symposium; San Diego, CA, USA (19 Aug 1984).

Low and high energy pulsed electron beams were used to generate radiation-induced transient attenuation in high-OH, Suprasil core, PCS fibers, demonstrating the energy dependence of the radiation damage and recovery mechanisms. A radiation resistant low-OH fiber was studied and its performance contrasted to that of

high-OH materials. Several fibers with differing core compositions were also studied.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 44030045335, 45391, 45772, 45873, 46389, 46390, 46391, 46392, 46393, 46432

46516 (AECL—7981) Acoustic lenses. Focusing in on defects. Kittmer, C.A. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Mar 1983. 26p. (CONF-8306215—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE84702979.

From International conference on pipeline inspection; Edmonton, Alberta, Canada (13 Jun 1983).

Acoustic lenses focus ultrasound to produce pencil-like beams with reduced near fields. When fitted to conventional (flat-faced) transducers, such lenses greatly improve the ability to detect and size defects. This paper describes a program developed to design acoustic lenses for use in immersion or contact inspection, using normal or angle beam mode with flat or curved targets. Lens surfaces are circular in geometry to facilitate machining. For normal beam inspection of flat plate, spherical or cylindrical lenses are used. For angle beam or curved surface inspections, a compound lens is required to correct for the extra induced aberration. Such a lens is aspherical with one radius of curvature in the plane of incidence, and a different radius of curvature in the plane perpendicular to the incident plane. The resultant beam profile (i.e., location of the acoustic focus, beam diameter, 6 dB working range) depends on the degree of focusing and the transducer used. The operating frequency and bandwidth can be affected by the instrumentation used. Theoretical and measured beam profiles are in good agreement. Various applications, from zone focusing used for defect sizing in thick plate, to line focusing for pipe weld inspection, are discussed.

46517 (CONF-8409109—2) Effects of temperature on the response time of thermocouples and resistance thermometers. Carroll, R.M.; Shepard, R.L. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016855.

From Industrial temperature measurement symposium; Knoxville, TN, USA (10 Sep 1984).

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The response times of sheathed thermocouples and platinum resistance thermometers both bare and in thermowells were measured at temperatures up to 650°C using plunge tests and an in situ loop-current step-response (LCSR) measurement technique. Both methods of measurements agreed over a wide range of sensor sizes and response times, verifying the LCSR method. The response times were temperature dependent. The magnitude and direction of the temperature-dependence of response time varies from sensor to sensor. The response time of the sensor at the operating conditions must be measured when the sensor is at operating temperature.

46518 (DOE/ER/10916—1, pp 219-227) Using numerical techniques to improve the performance of triple hot-wire probes. Andreopoulos, J. (Univ. of Karlsruhe, Germany). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

This paper describes two numerical techniques which were found to improve greatly the performance of a triple hot wire probe with orthogonal wires. The first technique incorporates in the data analysis the dependence of coefficients k and h from the pitch and yaw angles of the instantaneous velocity vector. The second technique deals with the problem of non-orthogonality of the wires and suggests some methods to correct for this condition.

46519 (DOE/ER/10916—1, pp 228-233) Digital thermal anemometry. Stock, D.E.; Wells, M.R.; Shook, M. (Washington State Univ., Pullman). 1983. NTIS, PC A19/MF A01. File Number TI84003020. (CONF-8109248—).

From 7. biennial symposium on turbulence; Rolla, MO, USA (21 Sep 1981).

Calibration and data reduction techniques relying completely on digital systems are described for standard hot-wires, cross-wires, and split-film probes. These techniques allow the probe to be calibrated in the actual orientation which will be used. Success of the method depends on initially balancing a dual element probe such that both sensors respond identically to velocity changes.

46520 (INIS-mf—8861) On-line control systems in power plants 1982. (VGB Technische Vereinigung der Grosskraftwerksbetreiber e.V., Essen (Germany, F.R.)). 1982. 435p. NTIS (US Sales Only), PC A19/MF A01. File Number DE84780509.

Individual sections of the report were entered into the data base.

46521 (INIS-mf—9046) ICR studies of some anionic gas phase reactions and FTICR software design. Noest, A.J. (Amsterdam Univ. (Netherlands)). 11 May 1983. 125p. NTIS (US Sales Only), PC A06/MF A01. File Number DE84780609.

This thesis consists of two parts. Part one (Chs. 1-5) reports experimental results from mostly drift-cell ICR studies of negative ion-molecule reactions; part two (Chs. 6-11) concerns the design of software for an FTICR instrument. The author discusses successively: 1. ion cyclotron resonance spectrometry; 2. the gas phase allyl anion; 3. the (M-H) and (M-H2) anions from acetone; 4. negative ion-molecule reactions of aliphatic nitrites studied by cyclotron resonance; 5. homoconjugation versus charge-dipole interaction effects in the stabilization of carbanions in the gas phase; 6. the Fourier Transform ICR method; 7. the FTICR-software; 8. an efficient adaptive matcher filter for fast transient signals; 9. reduction of spectral peak height errors by time-domain weighing; 10. Chirp excitation; 11. Compact data storage. The book concludes with a Dutch and English summary.

46522 (LA-UR—84-2540) Development of a dynamic radiographic capability using high-speed video. Bryant, L.E. Jr. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 7p. (CONF-840887—10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016477.

From 16. international congress on high speed photography and photonics; Strasbourg, France (27 Aug 1984).

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High-speed video equipment can be used to optically image up to 2000 full frames per second or 12,000 partial frames per second. X-ray image intensifiers have historically been used to image radiographic images at 30 frames per second. By combining these two types of equipment, it is possible to perform dynamic x-ray imaging of up to 2,000 full frames per second. The technique has been demonstrated using conventional, industrial x-ray sources such as 150 kV and 300 kV constant potential x-ray generators, 2.5 MeV Van de Graaffs, and linear accelerators. A crude form of this high-speed radiographic imaging has been shown to be possible with a cobalt 60 source. Use of a maximum aperture lens makes best use of the available light output from the image intensifier. The x-ray image intensifier input and output fluors decay rapidly enough to allow the high frame rate imaging. Data are presented on the maximum possible video frame rates versus x-ray penetration of various thicknesses of aluminum and steel. Photographs illustrate typical radiographic setups using the high speed imaging method. Video recordings show several demonstrations of this technique with the played-back x-ray images slowed down up to 100 times as compared to the actual event speed. Typical applications include boiling type action of liquids in metal containers, compressor operation with visualization of crankshaft, connecting rod and piston movement and thermal battery operation. An interesting aspect of this technique combines both the optical and x-ray capabilities to observe an object or event with both external and internal details with one camera in a visual mode and the other camera in an x-ray mode. This allows both kinds of video images to appear side by side in a synchronized presentation.

46523 **(LA-UR—84-2598) Characterization of electronic streak tubes including one with internal CCD readout.** Weiss, P.B.; Black, P.; Oona, H.; Sprouse, L. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 15p. (CONF-840887—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016823.

From 16. international congress on high speed photography and photonics; Strasbourg, France (27 Aug 1984).

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Measuring techniques for characterizing electronic streak tubes including dynamic range and resolution are described. A particular tube with a CCD imaging device within the envelop is described.

46524 **(LA-UR—84-2654) Collimation techniques for dense object flash radiography.** Mueller, K.H. (Los Alamos National Lab., NM (USA)). Aug 1984. Contract W-7405-ENG-36. 8p. (CONF-840887—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016461.

From 16. international congress on high speed photography and photonics; Strasbourg, France (27 Aug 1984).

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In explosively driven experiments, flash radiography can record a wealth of information about material densities and boundaries. Obtaining accurate quantitative data from these radiographs requires careful design of the experiment so that one can control and measure the scattered radiation background that is a part of any experiment. We have used collimators at the x-ray source to match the incident x-ray flux to the transmission of the object, thereby reducing the production of scattered radiation while still preserving a complete view of the object. Multi-hole collimators (at the film plane) with a length-to-diameter ratio of ~ 20:1 have been used to measure the scattered radiation field with several exposure geometries and with various shielding methods.

46525 **(LA-UR—84-2676) Flash radiography as a quantitative tool.** Neal, T.R. (Los Alamos National Lab., NM (USA)). Aug 1984. Contract W-7405-ENG-36. 8p. (CONF-840887—8). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016465.

From 16. international congress on high speed photography and photonics; Strasbourg, France (27 Aug 1984).

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Flash radiographs have long been useful for interpreting dynamic events. Such interpretation ranges from merely looking at a radiograph to aid in understanding the event to fully deconvolving film densities to reconstruct actual masses and positions. Between these two extremes are the possibilities of using trained observers to select features of interest or of using densitometers to aid in such descriptions. Several examples of these latter methods will be illustrated to indicate that reasonable precision can be obtained in this way and that flash radiography can indeed be a quantitative science. The examples will be from the field of shock-wave hydrodynamics. The radiographs were taken at the PHERMEX facility, a 25-MeV machine emitting about 30 R at a meter in a pulse of 100 ns for these examples. The first situation involves the selection of the position of a thin, low-density beryllium foil embedded in a moving high-density material, uranium. The second will involve the selection of the location or of the alignment direction of step mass discontinuities such as those found in shock waves or in interfaces between materials of different density. Such discontinuities may be slowly curving, and the problem is that of determining tangents at selected locations. Both spall in lead and multiple intersecting shocks in lead will be described. The third situation will involve the selection of the alignment of the head of a rarefaction wave - the problem of a density gradient with a discontinuous first derivative. The example will be oblique reflection of a detonation wave from an open edge in the explosive PBX-9404. The last situation will involve the problem of a material density gradient with continuous first derivative. The example will be low-density material ejected from a lead surface that has been shocked. In this last case the answer is not a single selection, but a variation as a function of location.

46526 **(LA-UR—84-2696) Tomographic reconstruction of axially symmetric objects from a single radiograph.** Hanson, K.M. (Los Alamos National Lab., NM (USA)). Aug 1984. Contract W-7405-ENG-36. 9p. (CONF-840887—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016783.

From 16. international congress on high speed photography and photonics; Strasbourg, France (27 Aug 1984).

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In 1826 Abel presented the method of obtaining the profile of a circularly symmetric 2-D object from its projection. It is shown that the extension of Abel conversion, the reconstruction of a 3-D axially symmetric object from a single radiograph, offers significant benefits as an image analysis tool. These benefits include improved delineation of material boundaries, enhanced display of minor deviations from axial symmetry, as produced by defects, and accurate estimation of the linear attenuation coefficients of the materials. Frequently this technique allows observation of features in the object that are too subtle to be seen in the original radiograph.

46527 **(LBL—17032) Development of high responsivity Ge:Ga photoconductors.** Haegel, N.M.; Hueschen, M.R.; Haller, E.E. (Lawrence Berkeley Lab., CA (USA)). Jun 1984. Contract AC03-76SF00098. 16p. (CONF-840725—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016903.

From 3. international conference on infrared physics; Zurich, Switzerland (23 Jul 1984).

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Czochralski-grown gallium-doped germanium (Ge:Ga) single crystal samples with a compensation of 10^{-4} have been modified by the indiffusion of Cu to produce photoconductors which provide NEPs comparable to current optimum Ge:Ga detectors, but exhibit responsivities a factor of 5 to 6 times higher when tested at a background photon flux of 10^8 photons/sec at $\lambda = 93$ μm. The introduction of Cu, a triple acceptor in Ge which acts as a neutral scattering center, reduces carrier mobility and extends the breakdown field significantly in this ultra-low compensation material.

46528 **(LBL—17378) Preliminary evaluation of RCA C83036E prototype photomultiplier.** Lo, C.C.; Leskovar, B. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 10p. (CONF-841008—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016894.

From Nuclear power systems symposium; Orlando, FL, USA (31 Oct 1984).

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Characteristics of the prototype RCA C83036E 52 mm diameter photomultiplier have been measured. The results of the measurements of the gain, dark current, photocathode quantum efficiency, peak output current, electron transit time, and output pulse rise time as a function of voltage between anode and cathode are given. Furthermore, single photoelectron time spread, multiphotoelectron time resolution, pulse-height spectrum and afterpulse time spectrum were measured and are discussed.

46529 **(SAND—83-2195) Test plan for the forest-echo experiment.** Jelinek, D.A. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1984. Contract AC04-76DP00789. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017175.

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In this report, we describe a test plan to determine the characteristics of the average radar echo from a number of forested terrains. The data required to do this will be obtained by using a very narrow pulse-width (20 ns) radar and associated hardware on board a helicopter. Data will be taken as the helicopter makes straight and level passes over each terrain at a number of altitudes. Both deciduous and conifer forests will be overflown at different times of the year to determine the effect of seasonal changes. The report describes the hardware that will be used and the procedure that will be followed to gather the data. It also gives the theoretical statistical characteristics of the radar's video output and the amount of intrapulse and interpulse correlation expected.

46530 **(SAND—84-0895C) Thermoelectric inhomogeneity testing: principles, practices, and problems.** Reed, R.P. (Sandia National Labs., Albuquerque, NM (USA)). 3 Sep 1984. Contract AC04-76DP00789. 38p. (CONF-8409109—3). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016789.

From Industrial temperature measurement symposium; Knoxville, TN, USA (10 Sep 1984).

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Thermoelectric inhomogeneity is the anomalous variation of Seebeck, Peltier, and Thomson coefficients along a thermoelement. Where it exists, Seebeck inhomogeneity limits the accuracy to which a thermocouple can be generally calibrated and used. It is an insidious cause of error that is neither detected by nor eliminated by conventional calibration. It often occurs during use. It subtly degrades accuracy, sometimes acceptable, sometimes catastrophically. Well-demonstrated formal test methods have existed for more than 75 years yet adequate homogeneity is more often presumed than it is confirmed by test. The informal methods popularly used to check inhomogeneity are ineffective and have led many users to incorrectly discount the practical significance of inhomogeneity. This paper reviews the basis and limitations of quality specification, analysis, and testing for Seebeck inhomogeneity of thermocouple elements.

46531 **(UCRL—90491) Improvements in avalanche-transistor sweep circuitry for electrooptic streak cameras.** Thomas, S.W.; Griffith, R.L.; McDonald, W.R. (Lawrence Livermore National Lab., CA (USA)). 31 Aug 1984. Contract W-7405-ENG-48. 8p. (CONF-840887—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016195.

From 16. international congress on high speed photography and photonics; Strasbourg, France (27 Aug 1984).

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We have improved the performance of the avalanche-transistor deflector-driver (sweep) circuitry used in the high-speed, electrooptic streak camera at Lawrence Livermore National Laboratory (LLNL). In the previous design for the sweep circuit, trigger-to-output delay time drifted on some cameras. This delay drift is a function of a somewhat randomly unstable breakdown voltage of some avalanche transistors. Both temperature and differences in manufacturing methods for transistors affect this instability. However, a significant improvement in system performance is achieved by long-term burn in and by selection of only the most stable transistors for the sweep circuit. The peak-to-peak sweep voltage has been increased about 80% by increasing the number of avalanche transistors in the string and raising the Q of the resonant circuit. The result is an improvement in sweep uniformity by a factor of approximately 2. Design equations for selecting components are given. Fast-recovery diodes are used to prevent undershoot and to keep the beam out of the intensifier field of view until after the intensifier is gated off. The sweep time range has been extended to over 100 ns.

46532 **(UCRL—90540) Beam profiling in gigawatt 1064-nm lasers used in research on optical materials at Livermore.** Milam, D.; Peluso, S.E. (Lawrence Livermore National Lab., CA (USA)). 7 Sep 1984. Contract W-7405-ENG-48. 9p. (CONF-840872—26). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017045.

From SPIE annual technical symposium; San Diego, CA, USA (19 Aug 1984).

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Laser pulses with intensities ranging from 10^9 to 10^{11} watts/cm^2 are routinely used at Livermore to measure nonlinear properties of optical materials. The energy in each of these pulses is measured with an absorbing glass calorimeter. Both vidicon cameras and photographic emulsions are used to record the fluence distribution in laser beams. Pulse waveforms are recorded by a streak camera, or by a combination of a photodiode and an oscilloscope. This paper describes our procedures for using this data to determine the fluence and intensity for short duration laser pulses.

46533 **(UCRL—90649) Microwave measurement of the complex dielectric tensor of anisotropic slab materials.** King, R.J.; Yen, Y.H.; James, W.L. (Lawrence Livermore National Lab., CA (USA); Bell Communications Research, Inc., Holmdel, NJ (USA); Forest Products Lab., Madison, WI (USA)). Aug 1984. Contract W-7405-ENG-48. 13p. (CONF-840738—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017050.

From Progress in quantitative NDE; San Diego, CA, USA (8 Jul 1984).

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A linearly polarized electromagnetic wave incident on an anisotropic material suffers attenuation, phase change, and depolarization upon transmission through or reflection from the material. Here it is shown how the measured electrical properties of a wave transmitted through dimension lumber can be used to determine the complex dielectric tensor. The theory which applies equally to other lossy and anisotropic materials such as man-made composites having a 2 x 2 uniaxial tensor, is couched in terms of the measurable attenuation, phase change, and depolarization. A microwave measurement system has been developed for measuring these parameters. Results are given for extensive experiments conducted at 4.81 GHz on Douglas fir for moisture contents ranging from dry to complete saturation. The technique shows considerable promise as an accurate nondestructive diagnostic tool for evaluating the electrical, and hence, the physical and mechanical properties of semi-transparent anisotropic materials.

46534 **(UCRL—91423) Fundamental limitations in antenna resolution by maximum entropy methods.** Bevensee, R.M. (Lawrence Livermore National Lab., CA (USA)). Aug 1984. Contract W-7405-ENG-48. 17p. (CONF-840897—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017052.

From 21. International Union of Radio Science general assembly; Florence, Italy (28 Aug 1984).

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This paper summarizes work done during the past few years on antenna super-resolution of distant radiating sources, both incoherent with and without additive noise and coherent with and without additive noise.

46535 **Novel x-ray diffractometer/position-sensitive detector system.** Fraass, B.A.; Granfors, P.R.; Hilleke, R.O.; Simmons, R.O. (Physics Department and Materials Research Laboratory, University of Illinois at Urbana—Champaign, Urbana, Illinois 61801). *Review of Scientific Instruments;* **55**: No. 9, 1455-1460(Sep 1984). Contract AC02-76ER01198.

The principles, construction, and operation of a versatile, orientable x-ray diffractometer system having a position-sensitive detector are described. The system precisely and rapidly measures Bragg scattering from very weak scatterers such as quantum crystals of helium and hydrogen held in fixed orientation at precisely controlled extreme temperatures and pressures inside fixed bulky apparatus.

46536 **Automated pressure regulator.** Waxman, M.; Davis, H.A.; Horowitz, M.; Everhart, B. (Thermophysics Division, National Bureau of Standards, Washington, DC 20234). *Review of Scientific Instruments;* **55**: No. 9, 1467-1470(Sep 1984). Contract AI01-76PR06010.

A pressure regulator has been constructed that automatically nulls a sensitive differential pressure indicator of the type used in high-quality PVT experiments, thus permitting at least partial automation of such experiments. Distinguishing features are: high resolution, sufficient rigidity for operation in a pressure range up to 100 MPa, and a control logic that permits nulling of the pressure transducer, even if the initial state is very far from balance.

46537 **Retractable capillary doser.** Fowler, G.L.; Panitz, J.A. (Surface Science Division 1134, Sandia National Laboratories, Albuquerque, New Mexico 87185). *Review of Scientific Instruments;* **55**: No. 9, 1507-1508(Sep 1984). Contract AC04-76DP00789.

A retractable capillary doser is described which can place a reproducible coverage of molecules on a substrate in an ultrahigh-vacuum environment. An integral valve assembly controls the flow of molecules from the doser volume to the substrate. Automatic operation is achieved by controlling the valve and the position of the doser orifice from a commercial IEEE interface.

46538 **Source noise reduction in diode laser spectroscopy using the Faraday effect.** Laguna, G.A. (University of California, Los Alamos National Laboratory, Chemistry Division, Los Alamos, New Mexico 87545). *Applied Optics;* **23**: No. 13, 2155-2158(1 Jul 1984).

Polarization rotation via the Faraday effect was demonstrated for the first time as a technique for reduction of source noise in tunable diode laser spectroscopy. The technique was fully characterized by experiments and computer modeling. A comparison to other noise reduction techniques reveals that polarization rotation is potentially the most sensitive.

46539 **New method for obtaining individual component spectra from those of complex mixtures.** Honigs, D.E.; Hieftje, G.M.; Hirschfeld, T. (Department of Chemistry, Indiana University, Bloomington, Indiana 47405 (D.E.H., G.M.H.); and Department of Chemistry, Lawrence Livermore Laboratory, P.O. Box 808, Livermore, California 94550 (T.H.)). *Applied Spectroscopy;* **38**: No. 3, 317-322(May 1984).

In near-infrared reflectance analysis (NIRA), a computer is trained to recognize and quanitative the relationship between the near-infrared spectrum of a sample and the concentrations of one or more of the sample constituents. During this training process the computer implicitly generates the spectrum of the constituents in question, although this spectrum is ordinarily not available for operator inspection. In the present study, a method for displaying this implicit information is developed and evaluated. The resulting "reconstructed spectrum" can be of a specific chemical constituent in a sample or can be a composite spectrum of those components that collectively contribute to specific sample properties such as material strength or processing temperature, or to sensory characteristics such as the "hotness" of peppers. A comparison is made of this new spectral reconstruction to technique to established methods such as spectral stripping and factor analysis.

46540 **Measurement of megampere currents with optical fibers.** Veeser, L.; Kania, D.; Freeman, B.; Kruse, P.; Zimmerman, E. (Los Alamos National Lab., NM). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **380**: 300-304(1983). (CONF-830425—).

From Society of Photo-Optical Instrumentation Engineers conference; Santa Fe, NM, USA (11 Apr 1983).

Fiber optic sensors have been used routinely to measure multi-megampere currents. The sensors are low noise, absolutely calibrated, and electrically decoupled from the pulsed power source. Polarized light from a HeNe laser is guided past the current carrier by a single-mode, low-birefringence fiber. The magnetic field from the current causes a Faraday rotation of the light polarization which is detected by a polarization analyzer and photodiode at the end of the fiber. A rotation of about 250°/MA +/- 5% was observed, slightly less than the Verdet constant for non-birefringent silica glass. It was found that highly birefringent (polarization preserving) optical fibers do not work in this application. Current work is to ruggedize the sensor for field use with high-explosive-driven current sources by using a diode laser and single mode fiber couplers to replace the laboratory system of lenses and spatial filters.

4404 Well Logging Instrumentation

46541 **(SAND—84-1078) High-repetition rate neutron generator.** Weinlein, J.H. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1984. Contract AC04-76DP00789. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017201.

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A high-repetition rate neutron generator has been developed at Sandia National Laboratories. This generator was employed by Lawrence Livermore National Laboratories (LLNL) in a logging tool. The generator is capable of a 20-kHz repetition rate with 1000 neutrons/pulse. The electronic design of the generator and the method used to test it are discussed. 10 references.

46542 **(LA-tr—84-27) Developing oxygen logging equipment and method.** Popov, N.V.; Gorbunov, V.F. Translated from *Yadernaya Geofizika ;* No. 1, 192-197(1968). Contract W-7405-ENG-36. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84015896. DE84015896

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Determination of the position of the water-petroleum contact in strata saturated with fresh water must be most important when logging wells by the oxygen activation method. Oxygen is activated with neutrons with energies above 10.5 to 11.0 MeV; radioactive nuclei, decaying with a half-period of about 7.4 s, emit beta-particles with energies to 10 MeV, and gamma-quanta with energies of 6.1 MeV (75%) and 7.1 MeV (7%). So for activation it is necessary to use a neutron generator in which the (D, T) reaction is realized and the initial neutron energy is 14 MeV. Since the generators do not provide adequate neutron flux stability, a device for estimating changes in neutron yield must be used - the so-called monitor. To measure the gamma-radiation of induced radioactivity, it is best to use a scintillation counter with an NaI(Tl) or CsI(Tl) crystal. A pulsed method of recording induced radioactivity was developed and employed, based on a pulsed neutron generator. The neutrons are emitted by the generator in strong intense pulses. A detector, located 30 to 40 cm from the neutron generator target, records not only the gamma- radiation of induced radioactivity, but also the gamma-radiation formed in the radiation capture and inelastic scattering of neutrons. But the control circuit passes through only the detector signals that originate after inelastic scattering and radiation capture end. Thus, only induced and natural radioactivity are recorded.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

46543 **(MLM—3173) Thermal conductivity of iron/potassium perchlorate heat powder.** Love, C.M.; Etter, D.E.; Glaub, J.E. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 6 Sep 1984. Contract AC04-76DP00053. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017071.

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The thermal conductivity of unburned and burned Fe/$KC10_4$ heat powder pellets, of two different weight ratios, was determined as a function of pellet density and temperature. Thermal diffusivities as a function of temperature were measured by a laser flash diffusivity method and these data were combined with density and specific heat data to obtain the thermal conductivity results. The thermal conductivity of unburned 88/12 Fe/$KC10_4$ is about 25% higher than that of unburned 84/16 Fe/$KC10_4$; the thermal conductivity of unburned Fe/$KC10_4$ of both ratios about doubles on going from 50 to 70% of theoretical density. The thermal conductivity of burned 88/12Fe/$KC10_4$ is likewise significantly higher than that of burned 84/16 Fe/$KC10_4$. In general, the thermal conductivity of both 84/16 and 88/12 burned Fe/$KC10_4$ decreases slightly with increasing temperatures and increases with increasing density.

46544 **(MLM—3181(OP)) Parameters affecting hot wire ignition of thermite mixtures.** Munger, A.C.; Kelly, M.D. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1984. Contract AC04-76DP00053. 10p. (CONF-840867—8). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016941.

From 9. international protechnics seminar; Colorado Springs, CO, USA (6 Aug 1984).

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Ignitors have traditionally been fabricated using pyrotechnics or explosives that are sensitive to hot wire ignition. Most of these devices have a 1-Ω bridgewire and require 30 to 50 mJ of energy to function when delivered at a 3 to 5 A rate. The use of thermite mixtures has been established as thermal output charges in previous work. The components were simplified by using fewer chemical reactions to make the transition from the hot wire stimuli to the rapid burning of highly consolidated thermite mixtures. A second consideration is that the component should contain electrostatic discharge safe materials. Experiments have been conducted using a fine particle size - approximately 1-μm constituents in Al/Fe_2O_3 thermite blends consolidated to 1.8 g/cm³. The results of the tests have shown that, by using finely divided materials, sustained ignition can be obtained using a 3.5 A fire pulse into a 1-Ω Tophet C bridgewire. Using the same thermite for the ignition charge, booster charge, and the high density output reduces the number of constituents in the component, and so simplifies the problem of long-term compatibility. The potential for reactions is greatly reduced by using an oxidizer that is inherently stable.

46545 **(MLM—3184(OP)) Study of bridgewire size and pyrotechnic density relationships on all-fire levels.** Hegedus, S.M.; Munger, A.C. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1984. Contract AC04-76DP00053. 16p. (CONF-840867—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016946.

From 9. international protechnics seminar; Colorado Springs, CO, USA (6 Aug 1984).

The effects of bridgewire size and pyrotechnic density on the characteristics of a hot wire test device were evaluated. These characteristics were examined before and during initiation. Five bridgewire diameters and two loading densities were examined. Groups of hot wire devices of each bridgewire and density combination were fabricated. After final assembly, electrothermal response data were obtained on each test device, and a normalizing technique was introduced so that all groups of test devices could be compared. Then, each group of devices was subjected to a Langlie all-fire test to determine the threshold initiation current for each configuration. The results obtained reveal important boundary conditions and limiting factors related to the functioning characteristics of hot-wire devices. This information may be used to develop improved techniques of hot-wire device design such as computer modeling. Further study in this area would be valuable and is warranted.

46546 **(MLM—3185(OP)) Thermite and Fe/$KClO_4$: some thermodynamic calculations.** Woods, C.M. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1984. Contract AC04-76DP00053. 22p. (CONF-840867—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016945.

From 9. international protechnics seminar; Colorado Springs, CO, USA (6 Aug 1984).

Heats of reaction were calculated for thermite materials consisting of various mixtures of Al, Al/Si, Fe_2O_3, and Ni. The primary reaction taking place in these thermites was the reduction of iron oxide by aluminum to form metallic iron and aluminum oxide. It was demonstrated that by taking into account all of the favored secondary reactions, the excess thermal output could be accounted for. Adiabatic flame temperatures were calculated. Average heat capacities were calculated for the temperature ranges from ambient to the AFT. Heat capacity calculations were also made in an attempt to understand the relationship between pole temperature and calorific output of various thermite and Fe/$KClO_4$ components. Adiabatic flame temperatures were calculated using, as a closed system, the thermite material and its container. An empirical heat loss was subtracted from the available enthalpy of reaction. The remainder of the available heat was then used to calculate the system reduced adiabatic flame temperature which was termed the pole temperature projection. The results of these calculations were quite good when compared to actual measured values. Necessary heat losses were then calculated in the same fashion to fit the experimentally determined pole temperatures to a reduced AFT.

46547 **(MLM—3186(OP)) Development of a PETN DDT detonator.** Ewick, D.W. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1984. Contract AC04-76DP00053. 8p. (CONF-840867—9). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016944.

From 9. international protechnics seminar; Colorado Springs, CO, USA (6 Aug 1984).

A hot wire initiated deflagration-to-detonation transition (DDT) device using PETN is discussed. The design of the all-PETN explosive train is described. The mean all-fire current was found to be 2.04 A for a 200 msec constant current pulse at -54°C. A mean no-fire current of 1.03 A was obtained at 74°C using a 5 min pulse. A cut-back test was conducted to establish the minimum transition column length required. Reliable DDT was obtained with 5 mm long transition columns using a 2 mm diameter. The capability of the detonator to initiate XTX-8004 was demonstrated.

46548 **(NP—4770404) Studies on the initial phases of coal dust explosions.** (Commission of the European Communities, Brussels (Belgium). Directorate General for Employment and Social Affairs; Versuchsgrubengesellschaft m.b.H., Dortmund (Germany, F.R.)). 4 Jun 1982. 106p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84770404.

Coal dust explosions occur only if high energies, i.e. 10^3 to 10^6 times the minimum ignition energy, are released initially. Experiments with CH_4 accumulation near the heading face and with large-area overhead CH_4 layers are reported. When CH_4 accumulations near the face were ignited, coal dust explosions occurred at CH_4 volumes of 750 l. Overhead CH_4 accumulations were less dangerous. Even with CH_4 volumes of 2 m³ and above, the coal dust had to be stirred up for ignition. At Tremonia test mine, it was impossible without special aids to cause a coal dust explosion by igniting less than 1 m³ CH_4.

46549 **(ORNL—6018) Database assessment of the health and environmental effects of munition production waste products. Final report.** Ryon, M.G.; Pal, B.C.; Talmage, S.S.; Ross, R.H. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 217p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE84016512.

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This review provides information on several aspects of the waste problem connected with the manufacture of the munitions 2,4,6-trinitrotoluene or alpha-TNT, hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX). The objectives included: identifying those munition production wastes having the greatest potential for causing adverse health and environmental effects; providing the Army with a data base that will support future decision-making processes concerning additional delistings from RCRA requirements; and beginning the examination of the rationale for the selection of efficient methods of disposal of munition production wastes. The document includes the following: the physical and chemical properties of the primary munition compounds and some associated compounds, the manufacturing processes and production statistics for the Army ammunition plants, the metabolism and health effects in humans and test animals, the environmental fate and effects, and current and experimental waste treatment procedures. 181 references, 15 figures, 91 tables. (ACR)

46550 **(UCRL—53533) LX-10 and LX-17 moisture content and release.** Rigdon, L.P.; Seaton, D.L.; Pane, A.J. (Lawrence Livermore National Lab., CA (USA)). 17 Aug 1984. Contract W-7405-ENG-48. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016579.

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The results of four studies related to the moisture content, uptake, and release by two plastic-bonded explosives are reported. Formulations designated LX-10 and LX-17 were studied and are 95% HMX + 5% Viton A and 92.5% TATB + 7.5% Kel-F 800, respectively. Moisture content profiles for LX-17 following accelerated aging studies were obtained by analyzing dry machinings of pressed billets. These data are compared to the total hydrogen produced by materials test units containing pressed LX-17. Moisture

released by pressed billets in closed containers was measured indirectly by measuring the amount of H_2 produced, as released water reacted with uranium to produce UO_2 and H_2. The LX-10 and LX-17 billets were subjected to temperature variations involving thermocycling between -54°C and 74°C and isothermal aging for periods of 3 to 14 months. Two LX-17 billets were soaked in water for 16 hours, air dried, and re-tested for moisture. These experiments indicate that moisture is very slowly taken up and released by pressed, plastic-bonded explosives in diffusion-controlled processes. The processes are slow enough that several hours of wet machining the parts will not result in a significant moisture content increase. Experimental design data are presented.

46551 **Jet initiation and penetration of explosives.** Mader, C.L.; Pimbley, G.H. (Los Alamos National Lab., NM). *Journal of Energetic Materials;* **1003-1044**: 3-44(1983).

The two-dimensional Eulerian hydrodynamic code 2DE, with the shock initiation of heterogeneous explosive burn model called Forest Fire, is used to model numerically the interaction of jets of steel, copper, tantalum, aluminum, and water with steel, water, and explosive targets. The calculated and experimental critical condition for propagating detonation may be described by the Held V^2d expression (jet velocity squared times the jet diameter). In PBX 9502, jets initiate an overdriven detonation smaller than the critical diameter, which either fails or enlarges to greater than the critical diameter while the overdriven detonation decays to the C-J state. In PBX 9404, the jet initiates a detonation that propagates only if it is maintained by the jet for an interval sufficient to establish a stable curved detonation front. The calculated penetration velocities into explosives, initiated by a low-velocity jet, are significantly less than for non-reactive solids of the same density. The detonation products near the jet tip have a pressure higher than that of nonreactive explosives, and thus show the jet penetration. At high jet velocities, the calculated penetration velocities are similar for reactive and inert targets.

46552 **Jet initiation and penetration of explosives.** Mader, C.L.; Pimbley, G.H. (Los Alamos National Lab., NM). *Journal of Energetic Materials;* **1003-1044**: 3-44(1983).

The two-dimensional Eulerian hydrodynamic code 2DE with the shock initiation of heterogeneous explosive burn model called Forest Fire, is used to model numerically the interaction of jets of steel, copper, tantalum, aluminum, and water with steel, water, and explosive targets. The calculated and experimental critical condition for propagating detonation may be described by the Held V^2d expression (jet velocity squared times the jet diameter). In PBX 9502, jets initiate an overdriven detonation smaller than the critical diameter, which either fails or enlarges to greater than the critical diameter while the overdriven detonation decays to the C-J state. In PBX 9404, the jet initiates a detonation that propagates only if it is maintained by the jet for an interval sufficient to establish a stable curved detonation front. The calculated penetration velocities into explosives, initiated by a low-velocity jet, are significantly less than for non-reactive solids of the same density. The detonation products near the jet tip have a pressure higher than that of nonreactive explosives, and thus slow the jet penetration. At high jet velocities, the calculated penetration velocities are similar for reactive and inert targets. 8 references, 17 figures, 1 table.

4502 Nuclear

REFER ALSO TO CITATION(S) 45020046790, 47214

46553 **(AD-A—140653/7) Evaluation of the modified Sachs and Ledsham-Pike scaling of a nuclear air blast. Doctoral thesis.** Crawford, M.L. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). Jan 1983. 142p. (DS/PH—83-1). NTIS, PC A07/MF A01.

The accuracy of modified Sachs and Ledsham-Pike scaling of peak shock hydrodynamic variables from a nuclear burst in air is evaluated. The modified Sachs and Ledsham-Pike methods are corrections applied to the similarity transform which is used to compute shock overpressures and related variables for infinite homogeneous atmospheric ambient conditions. This similarity transform no longer applies when the burst and target are located at different altitudes, and the modified Sachs and Ledsham-Pike corrections are applied to account for these varying ambient conditions. In this dissertation, the modified Sachs shock positions, dynamic pressures, and overpressures and the Ledsham-Pike overpressures are compared to a fully two dimensional flux-corrected transport finite difference solution. The flux-corrected transport method maintains a sharp and steady shock with no oscillations. The numerical calculations include a real atmospheric model, the Doan and Nickel equation of state of air, and radiation energy losses. It is found that the modified Sachs and Ledsham-Pike overpressures are essentially identical, and that their overpressures compare with the numerical results more favorably in the ascending directions than in the descending directions. A new Ledsham-Pike correction factor is presented for the descending directions.

46554 **(AD-A—140705/5) Operations Nougat and Whetstone events: Hard Hat, Danny Boy, Marshmallow, Mudpack, Wishbone, Gumdrop, Diluted Waters, and Tiny Tot, 15 February 1962-17 June 1965. Final report 15 Feb 62-19 Jun 68.** Brady, W.J.; Horton, K.K.; Eubank, B.F. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)). 31 Jan 1984. 306p. NTIS, PC A14/MF A01.

This report is a personnel oriented history of DOD participation in underground nuclear weapons testing during Operations NOUGAT and WHETSTONE, test events HARD HAT, DANNY BOY, MARSHMALLOW, MUDPACK, WISHBONE, GUMDROP, DILUTED WATERS, and TINY TOT. It is the first in a series of historical reports which will include all DOD underground nuclear weapons tests and DOE underground nuclear weapons tests with significant DOD participation from 1962 forward. In addition to these volumes presenting a history of the underground nuclear test program, a later restricted volume will identify all DOD participants, (military, civilian, and their contractors) and will list their dosimetry data.

46555 **(AD-A—140802/0) Evolution of United States and NATO tactical nuclear doctrine and limited nuclear war options, 1949-1964. Master's thesis.** Maiorano, A.G. (Naval Postgraduate School, Monterey, CA (USA)). Dec 1983. 257p. NTIS, PC A12/MF A01.

The debate over nuclear weapons in Europe and their utility as part of NATO's forward defense strategy persisted since the mid-1950s. Existing tactical nuclear employment doctrine and strategies are based on obsolete criteria and defense concepts established when the U.S. possessed superiority in nearly all nuclear categories. NATO has allowed its tactical nuclear doctrine and arsenal of battlefield nuclear weapons to deteriorate, choosing instead to rely on the American strategic nuclear umbrella for all but the most localized of conflicts. This thesis examines the development, stagnation and decline of NATO tactical nuclear doctrine and strategy from 1949 to 1984. It analyzes four tactical nuclear postures, drawing from each to recommend a viable tactical nuclear strategy for NATO today. The presence and potential employment of tactical nuclear weapons make it imperative that NATO devise an effective limited nuclear war strategy.

46556 **(AD-P—003234/2) Nastran analysis of nuclear effects on helicopter transparencies.** Lin, P.T.; Jorgenson, J.S. (Goodyear Aerospace Corp., Litchfield Park, AZ (USA)). Dec 1983. 13p. NTIS, PC A02/MF A01.

This paper deals with the linear and geometric nonlinear analysis of the gunner's window on the AH-1S Cobra helicopter in response to a nuclear overpressure environment. The work was sponsored by the Applied Technology Laboratory, U.S. Army Research and Technology Laboratories (AVRADCOM), Fort Eustis, Virginia. Both monolithic stretched acrylic and multilayered transparency configurations are considered in this report. Comparison analyses using both the NASTRAN finite element program and classical Timoshenko plate theory show good agreement. Comparison of the analytical results with experimental observations made by other sources indicates that the geometric nonlinear mathematical models, rather than the linear models, are the more realistic and appropriate representation of transparency response to nuclear overpressure loading in the range considered. It is shown that the classical analysis of a simplified equivalent configuration serves as a

useful checkpoint, while finite element programs, such as MSC/NASTRAN, are the necessary analytical tools to examine the complicated configurations and loading conditions.

46557 **(INIS-mf—8885) Origin and effect of the nuclear electromagnetic pulse (NEMP).** Ochs, W.; Schmidt, H.U. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Stohl (Germany, F.R.). Inst. fuer Naturwissenschaftlich-Technische Trendanalysen). May 1982. 19p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE84780607.

This report tries to give a concise and qualitative description on the origin of the NEMP and to explain its extent of damage. An abbreviated version of this report is planned to be published in the "UMSCHAU".

46558 **(SAND—84-1202C) CAE integration in the nuclear weapons complex.** Sharp, J.; Jones, J. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 9p. (CONF-8410101—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84013803.

From 6. autofact conference; Anaheim, CA, USA (1 Oct 1984).

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Sandia National Laboratories has been assigned responsibility to lead the effort to integrate computer aided engineering (CAE) within the Department of Energy's Nuclear Weapons Complex (NWC). Our objective is to provide an interactive automated engineering information system for creating, releasing, controlling, exchanging, and tracking of product definition data within the NWC from a personal workstation. This paper describes the highlights to date and plans for the future.

46559 **(UCRL—90178) Neutron spectra as a function of angle at two meters from the Little Boy assembly.** Griffith, R.V.; Huntzinger, C.J.; Thorngate, J.H. (Lawrence Livermore National Lab., CA (USA)). 2 Jul 1984. Contract W-7405-ENG-48. 32p. (CONF-840627—10). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017033.

From 29. annual meeting of the Health Physics Society; New Orleans, LA, USA (3 Jun 1984).

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Measurements of neutron spectra produced by the Los Alamos National Laboratory (LANL) Little Boy replica assembly (Comet) were made with a combined multisphere and liquid scintillator system, that has been widely used at the Lawrence Livermore National Laboratory. The combined system was used for measurements at the side (90°) and nose (0°) of the assembly; additional measurements were made at 45° using only the liquid scintillator. Data were obtained at two meters from the center of the reactive region of the assembly, with good agreement between the multisphere and scintillator results. Comparison with liquid scintillator measurements performed by experimenters from the Canadian Defence Research Establishment, Ottawa (DREO) and calculations from LANL depended on the specific angle, obtaining the best agreement at 90°. 32 references, 11 figures, 4 tables.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

46560 **(UCRL—90795) Effect of mountain wave dynamics on orographic storms.** Bradley, M.M.; Wilhelmson, R.B. (Lawrence Livermore National Lab., CA (USA); Illinois Univ., Urbana (USA). Dept. of Atmospheric Sciences). Jun 1984. Contract W-7405-ENG-48. 4p. (CONF-841059—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE84014713.

From 3. American Meteorological Society conference on mountain meteorology; Portland, OR, USA (15 Oct 1984).

A review of the atmospheric structure of eight orographic storms over the Glamorgan Hills of south Wales indicates that mountain waves may be fairly common within such storms. Numerical simulations using a new, dynamic model tend to confirm the presence of these waves. The model results strongly support the hypothesis that mountain wave effects were responsible for the previously unexplained sensitivity of the Bergeron seeder-feeder mechanism to the low-level wind speed. 5 references, 3 figures.

46561 **Simulation of stationary and transient geopotential-height eddies in January and July with a spectral general circulation model.** Malone, R.C.; Pitcher, E.J.; Blackmon, M.L.; Puri, K.; Bourke, W. (Institute for Geophysical and Planetary Physics, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of the Atmospheric Sciences;* **41**: No. 8, 1394-1419(15 Apr 1984).

We examine the characteristics of stationary and transient eddies in the geopotential-height field as simulated by a spectral general circulation model. The model possessess a realistic, but smootheed, topography. Two simulations with perpetual January and July forcing by climatological sea surface temperatures, sea ice, and insolation were extended to 1200 days, of which the final 600 days were used for the results in this study. We find that the stationary waves are well simulated in both seasons in the Northern Hemisphere, where strong forcing by orography and land-sea thermal contrast exists. However, in the Southern Hemisphere, where no continents are present in midlatitudes, the stationary waves have smaller amplitude than that observed in both seasons. In both hemispheres, the transient eddies are well simulated in the winter season but are too weak in the summer season. The model fails to generate a sufficiently intense summertime midlatitude jet in either hemisphere, and this results in a low level of transient activity. The variance in the tropical troposphere is very well simulated. We examine the geographical distribution and vertical structure of the transient eddies. Fourier analysis in zonal wavenumber and temporal filtering are used to display the wavelength and frequency characteristics of the eddies.

46562 **Pollen sampling and dispersion studies at Brookhaven National Laboratory.** Raynor, G.S.; Smith, M.E.; Singer, I.A.; Ogden, E.C. (Brookhaven National Lab., Upton, NY). *Journal of the Air Pollution Control Association;* **11**: No. 10, 1-6(1961). (CONF-610606—).

From 54. annual APCA meeting; New York, NY, USA (11 Jun 1961).

This paper is for the most part a description of various pollen samplers that have been developed as part of the pollen sampling program at Brookhaven National Laboratory. Preliminary data from studies to date and plans for future research are presented.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 50020045479, 45481, 46609, 46611, 46751, 46752

46563 **(BNL—35123) Regional scale Lagrangian nonlinear chemistry model for acid deposition.** Kleinman, L.I. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 4p. (CONF-841059—11). NTIS, PC A02; 3; GPO Dep. File Number DE84016442.

From 3. American Meteorological Society conference on mountain meteorology; Portland, OR, USA (15 Oct 1984).

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A receptor oriented Lagrangian photochemical model was applied to the problem of determining the change in wet deposition of SO_4^{-2} and NO_3^- caused by a decrease in emissions of SO_2, NO/sub x/, or reactive hydrocarbons (HC). Boundary layer concentrations of acidic substances, HNO_3 and SO_4^{-2}, acid precursors, SO_2 and NO/sub x/, and oxidants were calculated for different emission conditions. The response of a precipitating system to the ambient concentration changes so produced was then qualitatively determined based upon several simplifying assumptions regarding the fate of S- and N- pollutants in clouds. Calculations were performed for a fair weather period in July 1978 and results compared with air quality monitoring data collected at the SURE (Sulfate Regional Experiment) station in Duncan Falls, Ohio. For one of the days studied, the fractional change in wet deposition of SO_4^{-2} and NO_3^-

was determined for factor of two decreases in SO_2, NO/sub x/, and HC emissions. 10 references, 2 figures, 3 tables.

46564 **(CONF-840803—12) Formaldehyde levels in forty East-Tennessee homes.** Hawthorne, A.R.; Gammage, R.B.; Dudney, C.S.; Matthews, T.G.; Erdman, D.J. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016672.

From 3. international conference on indoor air quality and climate; Stockholm, Sweden (20 Aug 1984).

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Extensive measurements of formaldehyde levels were conducted in 40 East Tennessee homes as part of a larger indoor air quality study. Measurements were made with passive, integrating monitors for a period of 24 h in three rooms of each house and outdoors as part of a larger indoor air quality study. Monthly measurements of this type were made in the study houses from April through mid-December of 1982. Over 6000 formaldehyde field measurements were made during the study. The measured formaldehyde concentrations were generally lower in older homes. Older houses averaged 40 ppB of formaldehyde while houses less than 5 years old averaged 80 ppB. Formaldehyde levels exhibited a statistically significant temperature dependence in most homes with formaldehyde concentrations greater than 80 ppB. Homes with ureaformaldehyde foam insulation were more likely to show this relationship. 9 references, 2 figures, 1 table.

46565 **(CONF-8406166—1) Impact of alcohol fuels on urban air pollution: methanol photochemistry study.** Whitten, G.Z.; Pullman, B.; Pefley, R.K. (Systems Applications, Inc., San Rafael, CA (USA); Santa Clara Univ., CA (USA)). Jun 1984. Contract FG03-84CE50036. 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84012950.

From Methanol symposium; El Monte, CA, USA (29 Jun 1984).

The past decade of research has clearly established methanol as one of the leading candidates from an environmental standpoint to replace petroleum in the ground transportation sector. Early studies, although limited, have indicated that in like operational circumstances methanol generated emissions can be as low as or lower than hydrocarbon emissions in photochemical reactivity. During the study, the smog chamber facilities at the University of Santa Clara have been used to conduct further validation studies of methanol's photochemistry. The facility consists of a 100 cubic foot aluminum and Pyrex chamber with an enclosed FEP Teflon bag. Eighty-four blacklights and eighteen sunlamps provided the solar simulation. The study primarily focused on neat methanol's exhaust and evaporative emissions photochemistry. Methanol/gasoline blends were considered in an introductory way. Three series of photochemistry experiments were performed. The first series consisted entirely of hydrocarbon surrogates and methanol exhaust surrogates. The second series involved hydrocarbon surrogates and actual methanol vehicle exhaust. The third series compared exhaust and evaporative emissions from a base gasoline and a methanol/gasoline blend.

46566 **(DOE/EV/02386—23) Photophysics and chemistry at PAH compounds. Progress and proposed technical program.** Pope, M.; Geacintov, N.E. (New York Univ., NY (USA). Dept. of Physics). 1984. Contract AC02-76EV02386. 38p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017342.

The work can be divided into four main areas that represent the evolution of biological and material damage from radiation and environmental impacts. The four areas are as follows: Part I deals with early events in radiation absorption in polycyclic aromatic hydrocarbons (PAH) that precedes chemical changes. The major components in this phase are electronically excited states, such as excitons and charge carriers. This includes theoretical and experimental studies; in some cases, the model compounds used are not PAH compounds, but are molecular solids that exhibit properties that should also exist in the PAH compounds. In Part II, we discuss particulate photophysics in which our photoemission studies play a major role. Here too, there are fundamental theoretical and experimental aspects. In Part III, we discuss the chemical reactions produced by the interaction of electronically excited states of PAH compounds with aqueous systems, and in Part IV, we discuss the reactions of PAH compounds and their derivatives that precede biological damage in living systems. As mentioned in our previous report, all of the above are relevant to an understanding of the mechanism of environmentally induced damage to living systems, either by radiation or by the products of combustion. In addition, some possible strategies for breaking the chain that leads to biological damage flow from our results.

46567 **(DOE/OR/21400—1) Analysis of possible future atmospheric retention of fossil fuel CO_2.** Edmonds, J.A.; Reilly, J.; Trabalka, J.R.; Reichle, D.E. (Institute for Energy Analysis, Washington, DC (USA); Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 166p. NTIS, PC A08/MF A01; GPO Dep. File Number DE84016858.

This report investigates the likely rates and the potential range of future CO_2 emissions, combined with knowledge of the global cycle of carbon, to estimate a possible range of future atmospheric CO_2 concentrations through the year 2075. Historic fossil fuel usage to the present, growing at a rate of 4.5% per year until 1973 and at a slower rate of 1.9% after 1973, was combined with three scenarios of projected emissions growth ranging from approximately 0.2 to 2.8% per year to provide annual CO_2 emissions data for two different carbon cycle models. The emissions scenarios were constructed using an energy-economic model and by varying key parameters within the bounds of currently expected future values. The extreme values for CO_2 emissions in the year 2075 are 6.8×10^{15} and 91×10^{15} g C $year^{-1}$. Carbon cycle model simulations used a range of year - 1800 preindustrial atmospheric concentrations of 245 to 292 ppM CO_2 and three scenarios of bioshere conversion as additional atmospheric CO_2 source terms. These simulations yield a range of possible atmospheric CO_2 concentrations in year 2075 of approximately 500 to 1500 ppM, with a median of about 700 ppM. The time at which atmospheric CO_2 would potentially double from the preindustrial level ranges from year 2025 to >2075. The practical, programmatic value of this forecast exercise is that it forces quantitative definition of the assumptions, and the uncertainties therein, which form the basis of our understanding of the natural biogeochemical cycle of carbon and both historic and future human influences on the dynamics of the global cycle. Assumptions about the possible range of future atmospheric CO_2 levels provide a basis on which to evaluate the implications of these changes on climate and the biosphere. 44 references, 17 figures, 21 tables.

46568 **(EGG-M—16784) Integrated global background monitoring network.** Wiersma, G.B. (Idaho National Engineering Lab., Idaho Falls (USA)). Aug 1984. Contract AC07-76ID01570. 32p. (CONF-840898—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE84016996.

From Symposium on research and monitoring in circumpolar biosphere reserves; Alberta, Canada (27 Aug 1984).

This paper describes the background and elucidates the need for an integrated global background monitoring network. This network should: establish reference levels for pollutants that have potential for global contaminatin, serve as an early warning site for detecting global spread of pollutants, and establish baseline levels for selected ecosystem parameters against which data from more impacted areas can be compared. This paper proposes the following: (1) establish an integrated global background monitoring network for pollutants and ecosystem parameters; (2) pollutant measurements be multi-media; (3) carry out ecosystem parameter studies in conjunction with pollutant measurements; (4) the network be maintained for an indefinite period of time; (5) the network be established using the international biosphere reserve system as the universe from which a subset of monitoring sites are drawn; and (6) that the project be under the overall direction of the Global Environmental Monitoring System. 43 references, 1 figure, 1 table.

46569 **(LBL—17603) Controlling indoor air pollution from tobacco smoke: models and measurements.** Offermann, F.J.; Girman, J.R.; Sextro, R.G. (Lawrence Berkeley Lab., CA (USA)). Jul 1984. Contract AC03-76SF00098. 17p. (CONF-840803—16). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016888.

From 3. international conference on indoor air quality and climate; Stockholm, Sweden (20 Aug 1984).

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The effects of smoking rate, ventilation, surface deposition, and air cleaning on the indoor concentrations of respirable particulate matter and carbon monoxide generated by cigarette smoke are examined. A general mass balance model is presented which has been extended to include the concept of ventilation efficiency. Following a review of the source and removal terms associated with respirable particles and carbon monoxide, model predictions to various health guidelines are compared. 20 references, 1 figure.

46570 **(NP—4770377) Wet and dry deposition of acid-forming atmospheric trace substances.** Perseke, C. (Frankfurt Univ. (Germany, F.R.). Fachbereich Geowissenschaften). 16 Dec 1982. 207p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE84770377.

Wet/dry measurements have shown that wet deposition plays a dominant part in scavenging sulphate, nitrate and chloride vis-a-vis dry deposition of aerosol particles. In contrast to regional distribution of SO_2 and NOsub(x) concentrations, regional distributions of sulphate and nitrate concentrations in the rain show but minor regional differences between polluted and clean-air regions. Increased trace substance concentrations in precipitation are observed with low-amount precipitation. Deposition of free acids is of some interests for an evaluation of the effect of "acid" precipitations on ecosystems. In areas of high SO_2 and NO_2 concentrations, potential acid deposition by dry-deposited SO_2 and NOsub(i) may contribute more to acid deposition than wet H^+ deposition. In urban and rural regions, an enrichment of nitrate was found in the rain as opposed to the aerosol on comparing the sulphate/nitrate ratio in rain and aerosol.

46571 (UCID—19851, pp 7-81) **Physical measurements in ASCOT.** Hosker, R.P. Jr. (Atmospheric Turbulence and Diffusion Lab., Oak Ridge, TN). Aug 1983. NTIS, PC A16/MF A01. File Number TI84008553.

In Atmospheric studies in complex terrain. Technical progress report, FY 1979-FY 1983.

Field measurements made during 1979-1981 within the ASCOT program are described with emphasis on the rationale for the measurement effort, instruments and techniques used, and data handling procedures. Limitations in current efforts are discussed and suggestions for future work are presented.

46572 (UCID—19851, pp 83-185) **Physical concepts.** Clements, W.E. (Los Alamos National Lab., NM). Aug 1983. NTIS, PC A16/MF A01. File Number TI84008553.

In Atmospheric studies in complex terrain. Technical progress report, FY 1979-FY 1983.

Research on the physics of complex terrain meteorology performed to date in the ASCOT program is summarized. The major focus has been on the nocturnal meteorology in the Geysers geothermal area. Nocturnal drainage flow on simple slopes, complex slope effects, valley and basin effects, interactions of drainage winds with external meteorology, transport and dispersion, and recommendations for additional work are discussed.

46573 (UCID—19851, pp 187-236) **Modeling.** Yamada, T. (Los Alamos National Lab., NM). Aug 1983. NTIS, PC A16/MF A01. File Number TI84008553.

In Atmospheric studies in complex terrain. Technical progress report, FY 1979-FY 1983.

Work on the development of mathematical models for predicting the transport and dispersion of air pollution in complex terrain is described. Flow models developed outside the ASCOT program are reviewed along with progress to date in the ASCOT program. The remaining objectives of the ASCOT modeling effort are also described.

46574 **(UCRL—90297) Aspects of the comparison of stratospheric trace species measurements with photochemical models.** Connell, P.S.; Wuebbles, D.J. (Lawrence Livermore National Lab., CA (USA)). Aug 1984. Contract W-7405-ENG-48. 7p. (CONF-8409122—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE84017028.

From Quadrennial ozone symposium; Halkidiki, Greece (3 Sep 1984).

Observation and measurement of reservoir species, including H_2O_2, $ClONO_2$, HNO_4, HOCl, N_2O_5 and others, can potentially test some portions of photochemical models of the stratosphere, leading to improvements and increased confidence in model predictions. But abundance measurements of a single reservoir species without accompanying values for other species do not serve, in most cases, to constrain the related model mechanism and parameters within the recognized uncertainties. This follows from the sensitivity of abundance of a species to fluctuations in its long-lived precursors from transport processes. A better test of theory would be provided by correlation studies in which precursor concentrations and photolytic fluxes are measured simultaneously and in the same air volume as the reservoir species. Three recent reported differing observations or upper limits for H_2O_2 give an example of the difficulties. All three reported values could be nearly consistent with the current LLNL one-dimensional stratospheric photochemical model, depending on the values of O_3, NO/sub x/ and H_2O appropriate to each measurement. The important precursors in each case can be identified by consideration of the appropriate kinetics and observed precursor variability. 10 references, 3 figures, 1 table.

46575 **Frequency distributions for durations and volumes of rainfalls in the eastern United States in relation to acidic precipitation.** Evans, L.S. (Brookhaven National Lab., Upton, NY (USA)); Raynor, G.S.; Jones, D.M.A. *Water, Air, and Soil Pollution;* **23**: No. 2, 187-195(Aug 1984).

A significant percentage (between 17 and 40%) of all showers recorded on Long Island, NY, Urbana, IL, Franklin, NC, and Seaside Park, NJ, had durations less than 20 min. Similarly, a large percentage had durations less than 40 min (50, 46, and 32% for 3 yr at Urbana, IL, 65% at Coral Gables, FL, 50% at Franklin, NC, and 54% at Seaside Park, NJ). When all data from the six growing seasons were pooled, over 88% of all rainfalls were less than 160 min. Similar results were observed when volume measurements were made. Between 38 and 57% of all recorded showers had less than 1 mm at all five stations in the eastern United States. When all data were pooled, over 65% of all rainfalls were less than 3 mm. These data demonstrate that plant foliage is wetted during the growing season by numerous showers which are of short duration and low volume.

46576 **Application of thermal analysis and photoelectron spectroscopy for the characterization of particulate matter.** Dod, R.L.; Novakov, T. (Lawrence Berkeley Lab., CA). *ACS Symposium Series;* No. 199, 397-409(1982). Contract AC03-76SF00098.

Photoelectron spectroscopy (ESCA) and thermal evolved gas analysis (EGA) have been applied to characterize sulfur- and nitrogen-containing species in atmospheric particulate matter. Particulate amines and amides previously identified only by ESCA have been detected by EGA, a bulk method, for the first time. EGA and ESCA results suggest the existence of a sulfate similar to ammonium sulfate but with some of the ammonium ions replaced by a charged organic nitrogen complex. 8 references, 8 figures.

46577 **Pollutant scavenging in winter storms.** Scott, B. (Pacific Northwest Lab., Richland, WA). *Proceedings - Institute of Environmental Sciences;* 481-484(1978). Contract AC06-76RL01830.

During the months of March and December 1977, and January 1978, over a dozen storm events occurred in which precipitation samples were collected. During the storm events, subcloud air concentrations of sulfate were typically about 3 $\mu g/m^3$. Updraft velocities were $\geq$ 10 cm/s which implies that much of the subcloud sulfate mass was injested into the storms. The sulfates act as condensation nuclei for precipitation. The greatest sulfate washout occurs when precipitation particles are growing by riming.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 50030045582

46578 (ARL/TR—060, pp 128-129) **Environmental radiation monitoring and studies.** Duggleby, J.C.; Smith, P.A.; Lauder, R.A. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

Work undertaken by the Australian Radiation Laboratory in the area of environmental radiation monitoring is outlined. Monitoring of radioactive fallout has decreased. Emphasis has been placed on analysis of accumulated environmental samples for fallout from nuclear weapons tests for scientific rather than public health purposes. Other activities include the surveillance program for early detection of fresh fission products and monitoring during visits by nuclear powered warships.

46579 (EML—430) **Worldwide deposition of ^{90}Sr through 1982.** Larsen, R.J. (Department of Energy, New York (USA). Environmental Measurements Lab.). Jun 1984. 170p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE84017246.

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The total deposition of ^{90}Sr on the surface of the earth during 1982 was 0.7 PBq. This is the lowest total yearly deposit since the initiation of the Environmental Measurements Laboratory's global fallout program in the late 1950's. The worldwide cumulative deposit decreased to about 374.0 PBq. The last reported nuclear detonation in the atmosphere occurred at the Lop Nor test site in China on October 16, 1980. 12 references, 9 figures, 9 tables.

46580 (LA—9445-PNTX-D) **Supplementary documentation for an Environmental Impact Statement regarding the Pantex Plant: dispersion analysis for postulated accidents.** Dewart, J.M.; Bowen, B.M.; Elder, J.C. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84008063.

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This report documents work performed in support of preparation of an Environmental Impact Statement (EIS) regarding the Department of Energy (DOE) Pantex Plant near Amarillo, Texas. The report covers the calculation of atmospheric dispersion and deposition of plutonium following postulated nonnuclear detonations of nuclear weapons. Downwind total integrated air concentrations and ground deposition values for each postulated accident are presented. The model used to perform these calculations is the DIFOUT model, developed at Sandia National Laboratories in conjunction with Operation Roller Coaster, a field experiment involving sampling and measurements of nuclear material dispersed by four detonations. The DIFOUT model is described along with the detonation cloud sizes, aerosol parameters, and meteorological data used as input data. A verification study of the DIFOUT model has also been performed; the results are presented.

46581 (LA—9988-PR) **Stratospheric tritium sampling. Progress report, April 1982-March 1983.** Mason,A. (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016975.

As part of Project Airstream (sponsored by the USDOE), tritium gas and tritiated water vapor are sampled in the stratosphere. Airstream data show that three perturbations of the stratospheric tritiated water burden have occurred since 1980. An atmospheric nuclear detonation in 1980 injected about 2.1 MCi. The massive eruptions of the Mexican volcano El Chichon appeared to double the removal rate in 1982. An unusually large wintertime exchange with the upper stratosphere occurred between 1982 and 1983. 17 references, 5 figures, 5 tables.

46582 (LBL—17598) **Evaluation of indoor aerosol control devices and their effects on radon progeny concentrations.** Sextro, R.G.; Offermann, F.J.; Nazaroff, W.W.; Nero, A.V.; Revzan, K.L.; Yater, J. (Lawrence Berkeley Lab., CA (USA)). Feb 1984. Contract AC03-76SF00098. 16p. (CONF-840803—8). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016001.

From 3. international conference on indoor air quality and climate; Stockholm, Sweden (20 Aug 1984).

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Eleven portable air cleaning devices have been evaluated for control of indoor concentrations of respirable particles, and their concomitant effects on radon progeny concentrations have been investigated. Of the devices we examined the electrostatic precipitators and extended surface filters had significant particle removal rates, while the particle removal rates for several small panel-filters, an ion-generator, and a pair of mixing fans were found to be negligible. The evaluation of radon progeny control produced similar results; the air cleaners which were effective in removing particles were also effective in reducing radon progeny concentrations. Furthermore, at the low particle concentrations, plateout of the unattached radon progeny was found to be a significant removal mechanism. The overall removal rates due to deposition of attached and unattached progeny have been estimated from these data, and the equilibrium factors for total and unattached progeny concentrations have been calculated as a function of particle concentration. 7 references, 2 figures.

46583 **Adjoint transport calculations for sensitivity analysis of the Hiroshima air-over-ground environment.** Broadhead, B.L.; Cacuci, D.G.; Pace, J.V. III. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **46**: 638-640(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

5005 Site Resource And Use Studies

46584 **Two-dimensional simulations of drainage winds and diffusion compared to observations.** Garrett, A.J.; Smith III, F.G. (Savannah River Laboratory, E. I. du Pont de Nemours & Co., Aiken, SC 29808). *Journal of Applied Meteorology;* **23**: No. 4, 597-616(Apr 1984). Contract AC09-76SR00001.

A vertically integrated drainage flow model is developed from conservation equations for momentum and mass in a terrain-following coordinate system. Wind fields from the dynamical model drive to Monte Carlo transport and diffusion model. The model needs only topographic data, an Eulerian or Lagrangian time scale and a surface drag coefficient for input data, and can be started with a motionless atmosphere. Model wind and diffusion predictions are compared to observations from the rugged Geysers, California area. Model winds generally agree with observed surface winds, and in some cases may give better estimates of area-averaged flow than point observations. Tracer gas concentrations contours agree qualitatively with observed contours, and point predictions of maximum concentration were correctly predicted to within factors of 2 to 10. Standard statistical tests of model skill showed that the accuracy of the predictions varied significantly from canyon to canyon the Geysers area. Model wind predictions are also compared to to observations from the South Carolina Savannagh River Plant, which has gently rolling terrain. The model correctly simulated the slower development of drainage winds and slower deepening of the drainage layer in the Savannah River Valley, relative to the Geysers, California simulations. The South Carolina simulations and observations suggest that drainage winds are more frequent in the southeastern United States than is generally recognized. They may be responsible for some of the errors in air pollution concentration predictions made by Gaussian models, which assume homonogeneous winds and turbulence.

5006 Regulations

46585 (NP—4770410) Topics of pollution control - a European task. Goethel, G.F. (Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlechemie e.V., Hamburg (Germany, F.R.)). 1984. 25p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE84770410.

Topics of pollution control are discussed using as an example the imminent Power Plant Ordinance, the projected limitation of benzene concentration in Otto fuels, the discussion of lead-free motor fuel. The author states that the above measures will be almost unsuccessful when introduced in the FRG alone. European cooperation and coordination is a must in this sector in order to prevent unjust overburding of national industries.

46586 (PB—84-189935) National performance audit program: ambient air audits of analytical proficiency - 1982. Lampe, R.L.; Parr, B.F.; Bennett, B.I.; Pratt, G.; Mitchell, W.J. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Monitoring and Support Lab.). Jan 1984. 42p. (EPA/600/4—84-005). NTIS, PC A03/MF A01.

The report summarizes results of the Ambient Air Audits of Analytical Proficiency for the calendar year 1982. Audits were conducted for SO2, NO2, sulfate, nitrate, lead, carbon monoxide and hi-vol flow rate. The National Performance Audit Program is also described.

46587 (PB—84-189968) Summary of precision and accuracy assessments for the state and local air monitoring networks, 1981. Evans, E.G.; Rhodes, R.C. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Monitoring and Systems Lab.). May 1984. 100p. (EPA/600/4—84-032; R—257). NTIS, PC A05/MF A01.

Ambient air quality data collected by states and local agencies are used in planning the nation's air pollution control strategy, in determining if National Air Quality Standards are being achieved, and in determining long-term trends of air quality. Prior to the regulations of May 10, 1979, the procedures used in site selection, controlling equipment, and calculating and validating data varied considerably among agencies. To alleviate this problem the May 10, 1979, regulations imposed uniformity on the data collected and required precision and accuracy to be reported. This report covers the first year of collecting for precision and accuracy data from state and local monitoring agencies. The data are summarized first by state and pollutant, and then summarized by region and the nation. A brief comparison of the precision and accuracy from the Precision and Accuracy Reporting System and that from the independent performance audit program conducted by the Environmental Monitoring Systems Laboratory is presented.

46588 (PB—84-194562) EPA (Environmental Protection Agency) research outlook, 1984. (Environmental Protection Agency, Washington, DC (USA). Office of Research and Development). Feb 1984. 161p. (EPA/600/9—84-004). NTIS, PC A08/MF A01.

This document is the ninth in this series of reports to Congress. Research needs identified in this year's report include: Toxic Substances and Pesticides, Hazardous Wastes, Air and Radiation, Energy, Acid Rain, Drinking Water, and Water Quality as well as several other issues which cut across media lines.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 51010046529, 46734

46589 (ORNL/TM—8904) Simulation approach to understanding the processes that structure food webs. Jager, H.I.; Gardner, R.H.; DeAngelis, D.L.; Post, W.M. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 174p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE84016583.

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A simulation model of food web dynamics, WEB, was constructed and used in Monte Carlo experiments to study the relationship between structure and function in food webs. Four main experiments were designed using WEB. The first tested the robustness of food web structures at equilibrium to variations in the functional response of predators in the food web to the densities of their prey. The second experiment clarified the roles of predation and resource limitation in the process of structuring food webs. A third experiment studied the influence of productivity on food web structure and function using simulated food webs. The final experiment was designed to study the differential successes of generalists and specialists. The main advantage gained by using a simulation approach in each of these experiments was the ability to assess the roles played by processes of predation and competition in structuring model food webs. This was accomplished by interpreting the order of extinction events that occurred in the simulations and relating these to the species configurations at equilibrium. 61 references, 23 figures.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 51020045374, 46570, 46609, 46611, 46740

46590 (FWS/OBS—80/40.3) Effects of air pollution and acid rain on fish, wildlife, and their habitats: introduction. Report No. 3. Peterson, M.A. (Dynamac Corp., Rockville, MD (USA)). Jun 1982. 196p. NTIS, PC A09/MF A01. File Number TI84901620.

Air pollution and acid rain impacts on living resources are a major source of concern to the US Fish and Wildlife Service and other governmental agencies charged with the protection of natural resources and the environment. This introductory volume synthesizes the results of scientific research related to air pollution effects on fish and wildlife resources. It is intended for use as a general reference and to provide background information for the eight ecosystem specific reports in this series: Deserts, Forests, Grasslands, Lakes, Rivers and Streams, Tundra and Alpine Meadows, Urban Ecosystems, and Critical Habitats of Threatened and Endangered Species. Air pollutants related to effects on fish, wildlife and their habitats are classified into three categories: photochemical oxidants, particulates, and acidifying air pollutants. A general summary of pollutant origins, atmospheric transport, transformation and deposition is presented. The bulk of this report describes plant, animal, and ecosystem responses to air pollution as well as factors affecting the sensitivity of receptive ecosystems. The Introduction also briefly describes relevant features of air quality legislation. 530 references, 28 figures, 33 tables.

46591 (FWS/OBS—80/40.7) Air Pollution and Acid Rain, Report No. 7. Effects of air pollution and acid rain on fish, wildlife, and their habitats: grasslands. Peterson, M.A. (Dynamac Corp., Rockville, MD (USA)). Jun 1982. 71p. NTIS, PC A04/MF A01 - GPO*. File Number TI84901656.

This report on grassland ecosystems is part of a series synthesizing the results of scientific research related to the effects of air pollution and acid deposition on fish and wildlife resources. General aspects of grassland ecosystems relevant to a discussion of air pollution effects are presented along with a brief introduction to

various other types of ecosystem stresses. The bulk of this report describes plant, animal and ecosystem responses to air pollution within the following pollutant categories: photochemical oxidants, particulates, and acidifying air pollutants. The report closes with a discussion of relevant topics for future research. 140 references, 3 figures, 11 tables.

46592 **(FWS/OBS—80/40.8) Air Pollution and Acid Rain, Report 8. Effects of air pollution and acid rain on fish, wildlife, and their habitats: arctic tundra and alpine meadows.** Olson, J.E.; Adler, D. (Dynamac Corp., Rockville, MD (USA)). Jun 1982. 34p. NTIS, PC A03/MF A01 - GPO*. File Number TI84901670.

This report on arctic tundra and alpine meadow ecosystems is part of a series synthesizing the results of scientific research related to the effects of air pollution and acid deposition on fish and wildlife resources. Recently performed research reveals the growing air pollution problem in arctic tundra and alpine meadow ecosystems once thought to be relatively unpolluted. The ecosystem features which determine sensitivity to air pollution are described. Data related to the effects of air pollutants on biota and whole ecosystems are reviewed. Because very little work has been done on the effects of air pollution specifically in arctic and alpine ecosystems this report includes relevant information based on studies in other ecosystems. Suggestions are made for areas of further research. 68 references, 2 figures.

46593 **(FWS/OBS—80/40.9) Air Pollution and Acid Rain, Report 9. Effects of air pollution and acid rain on fish, wildlife, and their habitats: deserts and steppes.** Mirsky, E.N.; Harper, D.; Adler, D. (Dynamac Corp., Rockville, MD (USA)). Jun 1982. 43p. NTIS, PC A03/MF A01 - GPO*. File Number TI84901671.

This report on desert and steppe ecosystems is part of a series synthesizing the results of scientific research related to the effects of air pollution and acid deposition on fish and wildlife resources. The features of desert and steppe ecosystems which determine the sensitivity of these ecosystems to air pollution are described. Data related to the effects of air pollutants on biota and whole ecosystems are reviewed. The data come from both field and laboratory studies. Some general information based on studies in other ecosystems is included. Suggestions are made for areas of further research. In general there has been less concern for the effects of air pollutants on the biota of deserts and steppes than for those of other ecosystems. Much of the concern for, and research on, air pollution in desert and steppe ecosystems is related to fossil fuel powered electric generating plants. 47 references, 3 figures, 8 tables.

46594 (LMF—107, pp 381-384) **Use of fractal mathematics to estimate environmental dilution factors.** Seiler, F.A. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

In some health and environmental risk assessments, the environmental dilution of leachwaters from solid wastes has to be estimated. The recent mathematical theory of fractal objects is used to demonstrate that rivers and river basins are self-similar and that simple relations obtain between length and drainage area for rivers large and small. These relations and a few simple assumptions are used to derive realistic environmental dilution factors for leachwaters from solid waste deposits.

46595 **(PB—84-177831) Slurry trench construction for pollution migration control. Final report 15 Apr 82-20 Jul 83.** Spooner, P.A.; Wetzel, R.S.; Spooner, C.E.; Furman, C.A.; Tokarski, E.F. (JRB Associates, Inc., McLean, VA (USA)). Feb 1984. 258p. NTIS, PC A12/MF A01.

The handbook provides in-depth guidance on the use of slurry walls for the control of subsurface pollutants. It describes how these barriers can be employed for waste site remediation and presents the theory of their function and use. The handbook describes the essential elements of slurry wall feasibility, design, and construction. It also presents information on site investigation, associated remedial measures, maintenance and monitoring, and major cost elements. The handbook concludes with a series of evaluation criteria that correspond to the stages of a slurry wall installation. A Glossary of commonly used terms is also included. The handbook provides governmental and industrial technical personnel with the means of evaluating essential aspects of the application of this technique to the clean-up of uncontrolled hazardous waste sites. In conjunction with other publications in this series, it will assist in meeting the national goal of a cleaner, safer environment.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 51030045590, 45591, 45613, 45652, 45657, 45659, 46579

46596 (ARL/TR—060, pp 110-111) **Speciation of radionuclides in sediments and soils.** Williams, G.A.; Cooper, M.B. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

Of a number of organic solvents, only acetic acid was found to remove large amounts of lead 210 and radium 226 from soils and sediments. The very different speciation behaviour of the two radionuclides indicates that lead 210 originates by adsorption of water-transported lead 210 and not by ingrowth from its long-lived precursor, radium 226.

46597 (ARL/TR—060, pp 29-32) **Radon in Melbourne homes: a preliminary study.** Kennedy, K.N.; Peggie, J.R.; Wise, K.N. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

Preliminary results of radon data collected from four houses in the Melbourne metropolitan area are presented. The results indicate that radon levels are well below those measured in other countries.

46598 **(ARL/TR—062) Radiological status of the Monte Bello Islands, May 1983.** Cooper, M.B.; Lokan, K.H.; Williams, G.A.; Toussaint, L. (Australian Radiation Lab., Melbourne). Oct 1983. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702916.

The results of a radiological survey of the Monte Bello Islands, performed in May 1983, are presented. The radiation environments of the sites of the two atomic weapons tests conducted over land, in 1956, on Trimouille Island and Alpha Island are described. The radiation fields at both ground zero locations are now relatively low, and present no health risk to the casual visitor. The radiation field on the southern and central parts of Trimouille Island, adjacent and downwind of the 1952 atomic weapons test offshore on HMS Plym is also described. The southern part of Trimouille Island is essentially free of radioactive contamination, whereas in the central part of the island the fallout pattern from this test is evident. Radioactive metal fragments containing Cobalt-60 were observed in large numbers scattered throughout the central part of Trimouille Island. The radioactive content was typically 6 kBq/kg. A number of soil samples from the two ground zero locations, and from central and southern Trimouille Island, were collected and analysed for radionuclide concentrations. As well, samples of oysters were obtained from three sites on Trimouille Island. There was no significant radioactive contamination of the oyster flesh or shells.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 51050045650

5106 Regulations

REFER ALSO TO CITATION(S) 51060046588

46599 **(ORNL/TM—9035) PCB annual report for Oak Ridge National Laboratory, 1982.** Clark, T.T.; Eisenhower, B.M. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016581.

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Stringent government regulations control the use and disposal of polychlorinated biphenyl (PCB) materials. These same regulations require accurate recordkeeping by the owner/operator of a facility where PCBs are in use. This report details efforts to comply with the Toxic Substance Control Act and the US EPA's newly formulated regulations. This document provides detailed records of PCB materials still in use, PCB wastes generated, their origins, storage of PCB wastes and offsite shipments of this waste during CY 1982.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 52010045599, 46589, 46734

46600 **(DOE/EV/01599—257-Pt.1) Dissolved organic matter and lake metabolism: biogeochemistry and controls of nutrient flux dynamics in lakes. Technical progress report, 1 August 1983-31 August 1984. Part 1.** Wetzel, R.G. (Michigan State Univ., Hickory Corners (USA). W.K. Kellogg Biological Station). 1984. Contract AC02-76EV01599. 90p. (COO—1599-257-Pt.1). NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84016909.

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The quantitative capacities of larger rooted aquatic plants, microflora attached to the large aquatic plants and to sediments, and the open-water phytoplankton algae and bacteria to control the fluxes and loadings of nutrients within lakes are being investigated. Each of the major communities of the wetlands, littoral zone, sediments, and open water are being analyzed to evaluate their capacities to regulate nutrient fluxes and loadings to and from the open water. All of the component subprograms are coupled to each other and address the general question of quantifying the regulatory capacities of attached macrophytes and microflora for nutrient loadings and recycling, and how these biotic controls affect phytoplankton competition, succession, and productivity. 92 references, 7 figures.

46601 **(FWS/OBS—83/05) Ecology of estuarine channels of the Pacific Northwest coast: a community profile.** Simenstad, C.A. (Washington Univ., Seattle (USA). Fisheries Research Inst.). Dec 1983. 192p. NTIS, PC A09/MF A01. File Number TI84901351.

This report on the estuarine channel habitats of the Pacific Northwest is one of a series of community profiles that synthesize useful information about specific natural coastal habitats. This profile will assist environmental scientists and biologists and coastal planners and managers who are interested in the open-water channels of coastal estuaries from the Straits of Juan de Fuca in Washington, south to Cape Mendocino, California. The profile describes the geomorphological, hydrological, chemical, and biological components and natural processes of the channels, their energy interchange, and interactions among adjacent habitats. In combination these habitat components and their interactions dictate the ecological structures and functions of the channels. The subject materials of the various chapters are integrated and summarized in the last chapter, and considerations for habitat management are identified. 523 references, 31 figures, 13 tables.

46602 (IAEA-TECDOC—298, pp 7-29) **Applications of environmental Caesium-137 for the determination of sedimentation rates in reservoirs and lakes and related catchment studies in developing countries.** Campbell, B.L. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Oct 1983. NTIS (US Sales Only), PC A05/MF A01. File Number TI84780553. (CONF-821284—).

From IAEA meeting on radioisotopes in sediment studies; Vienna, Austria (13 Dec 1982).

Environmental ^{137}Cs adsorbed on fine sediments has many uses as a tracer in erosion and sedimentation studies. The determination of sedimentation rates in lakes and reservoirs using ^{137}Cs as a geochronological marker is described in detail. From a survey of literature sources it is shown that ^{137}Cs levels in soils and sediments can be a powerful tool for the identification and quantification of soil erosion processes in catchment. It is suggested that ^{137}Cs studies can be profitably applied by developing countries whose limited soil resources are at high risk.

46603 (IAEA-TECDOC—298, pp 49) **Radioactive tracers in dynamic sedimentology.** Caillot, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Oct 1983. NTIS (US Sales Only), PC A05/MF A01. File Number TI84780553. (CONF-821284—).

From IAEA meeting on radioisotopes in sediment studies; Vienna, Austria (13 Dec 1982).

46604 (IAEA-TECDOC—298, pp 51-69) **Nuclear gauges for measuring sediment transport in torrential water courses.** Tazioli, G.S. (Dipartimento di Scienze dei Materiali e della Terra, Universita di Ancona (Italy)). Oct 1983. NTIS (US Sales Only), PC A05/MF A01. File Number TI84780553. (CONF-821284—).

From IAEA meeting on radioisotopes in sediment studies; Vienna, Austria (13 Dec 1982).

Solid transport in torrential streams in many areas of Mediterranean and other semiarid environments usually occurs during flash floods of short duration with suspended sediment concentrations higher than 100 g l^{-1}. Under these conditions it is very difficult to gauge sediment transport, except by using nuclear gauges. These are the most suitable means available for such situations because they can be used over a wide range of sediment concentrations and because they are able to resist bed load transport consisting of boulder-size material. This paper presents the main characteristics of nuclear turbiometric gauges with artificial gamma sources, and the calibration and operation of such gauges are discussed. Two types of completely automatic gamma transmission gauges installed at fixed points in drainage basins in Italy are described. Finally some possibilities of practical applications to different hydrodynamic situations and a new electronic equipment, projected by Laben of Milano, will also be discussed.

46605 **(IFIN-NP—24-1982) In-EDTA as activable tracer in hydrogeological investigations.** Stanescu, S.P.; Gaspar, E.; Spiridon, S.; Farcasiu, O.M.; Catilina, R. (Institutul Central de Fizica, Bucharest (Romania)). Dec 1982. 11p. (In Romanian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702946.

Two experiments are presented, on the possibilities of the use of indium in the form of the In-EDTA complex, as an activable tracer for hydrogeological studies. The determination of indium concentrations in the sampled water has been carried out by using the coprecipitation of indium with bismuth hydroxide, the neutron activation at the VVR-S reactor of the Institute for Nuclear Physics and Engineering - Bucharest and the measurement on the 417.0 keV line of sup(116m)In with the Ge(Li) spectrometric device. The advantages of the utilization of In-EDTA as a tracer for marking large volumes of water and of some long transit waters (of the order of months) have resulted.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 52020045362, 45374, 45451, 46549, 46570, 46622, 46742

46606 **(CONF-840888—1) Modeling effects of toxicants on aquatic systems.** Bartell, S.M.; O'Neill, R.V.; Gardner, R.H. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016594.

From ASCE Hydraulics Division specialty conference; Coeur d'Alene, ID, USA (14 Aug 1984).

Potential effects of chemicals on biomass production in aquatic systems are extrapolated from laboratory toxicological assays. The extrapolation requires that the effect of acute toxicity data be expressed as changes in growth parameters of species in a model (SWACOM). The model simulates seasonal production of biomass in a dimictic lake. Uncertainties concerning mode of chemical action and extrapolation from the laboratory to natural systems are explicitly retained in the calculations. Effects are estimated as probabilities of occurrence of predefined endpoints. 5 references.

46607 **(CONF-8310302—3) Relative effects of nitric and sulfuric acid deposition on watersheds.** Hemond, H.F.; Eshleman, K.N. (Massachusetts Inst. of Tech., Cambridge (USA)). 1983. 19p. Massachusetts Inst. of Technology, Cambridge, MA 02139. File Number TI84901572.

From MIT industrial liaison program symposium on using coal benignly; Cambridge, MA, USA (23 Oct 1983).

The impact of acid deposition on the chemistry of Bickford Reservoir in central Massachusetts is substantially mitigated by nearly quantitative retention of nitrate by the watershed. In contrast to other northeastern US watersheds, stream and water column nitrate levels are very low (I μeq/liter), and a nitric acid pulse accompanying spring runoff has not been observed in two years of study. Major differences in nitrogen processing among northeastern US watersheds appear to significantly alter watershed susceptibility to acid deposition, and may be of comparable importance to soil depth and mineralogy in the identification of acid-sensitive ecosystems. The routine assessment of nitrate retention in potentially vulnerable stream and lake waters is suggested, and management practices to enhance nitrate retention on potentially acid-sensitive watersheds should be explored. 21 references, 4 figures, 1 table.

46608 **(DGMK—294) Nature and origin of the hydrocarbons in sediments of Lake Constance.** Giger, W.; Schaffner, C.; Hollerbach, A.; Kalbfus, W.; Wachs, B.; Wagner, H.; Mueller, G.; Mueller, H. (Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlechemie e.V., Hamburg (Germany, F.R.)). Apr 1982. 26p. (In German). Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlechemie e.V., Hamburg (Germany, F.R.).

Six samples of sediment were taken from Lake Constance and hydrocarbons tested for biogenic or mineral oil origin with the following results: The high proportion of polar extractable matter is indicative of a biogenic origin. 2. The alkanes and alkenes are largely of biogenic composition, whereby an indication of fossile hydrocarbons was found for two samples. A distribution could not be made between mineral oil-derived hydrocarbons and other fossile hydrocarbons because of the low proportions present. 3. The composition of the aromatic fraction was indicative of a biogenic or pyrolytic origin.

46609 **(EPRI-EA—3221-Vol.2) Integrated Lake-Watershed Acidification Study. Volume 2. Hydrologic analysis. Final report.** Murdoch, P.S.; Peters, N.E.; Newton, R.M. (Geological Survey, Albany, NY (USA); Smith Coll., Northampton, MA (USA). Dept. of Geology). Jul 1984. 71p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920485.

A thesis of the Integrated Lake-Watershed Acidification Study (ILWAS) has been that a lake receiving more of its input water from the deeper soil horizons will be more alkaline. To test this hypothesis two very similar lake basins in the Adirondack Mountains have been studied in detail. Both basins receive about 120 cm of precipitation annually with a pH value of about 4.2. Yet one lake (Woods) has a pH of about 4.7, the other (Panther) has a pH of about 7. Hydrologic and geological data from the basins were analyzed for evidence to support this hypothesis. The following items were considered in the analyses: (1) the thickness of till and the capacity for water to pass through it before reaching the lake, (2) the flashiness of runoff and the degree of flow equalization by ground water, (3) the flow duration curves in response to high precipitation events, (4) recession curves representing ground water drawdown in the winter when the watershed was covered by snow, (5) the monthly changes in watershed storage including surface retention, soil moisture, and ground water, and (6) the magnitude of ground water drawdown in the summer and subsequent recharge in the fall. Hydrologic measurements and calculations indicate that the pH 7 lake receives about 10 times as much of its inflow from deep ground water. In the two lake-watersheds the distribution of precipitation between shallow and deep ground water pathways depends upon the rate at which water is applied to the soil and the relative size of the cross-sectional areas of the permeable materials orthogonal to the flow paths. Large amounts of water applied over short periods (e.g., during the rapid melting of snowpack) increase the relative amount of shallow flow and thus lake water acidity. 31 references, 18 figures, 11 tables.

46610 **(FWS/OBS—80/40.4) Air pollutin and acid rain, Report 4. Effects of air pollution and acid rain on fish, wildlife, and their habitats - lakes.** Potter, W.; Adler, D. (Dynamac Corp., Rockville, MD (USA)). Jun 1982. 141p. GPO*. File Number TI84901684.

This report summarizes the results of scientific research related to air pollution effects on fish and wildlife associated with lakes and wetlands. The effects of photochemical oxidants, particulates, and acidifying air pollutants on water quality and lake and wetland biota are summarized. The characteristics that indicate lake sensitivity to air pollutants, in particular acidifying pollutants, are presented. Socioeconomic aspects of air pollution impacts on lake ecosystems are discussed and areas of research are suggested to increase the understanding of the effects of air pollutants on lake and wetland ecosystems. 172 references, 1 figure, 6 tables.

46611 **(NP—4901887) Bedrock geologic control of sensitivity of aquatic ecosystems in the United States to acidic deposition.** Norton, S.A.; Akielaszek, J.J.; Haines, T.A.; Stromborg, K.L.; Longcore, J.R. (Maine Univ., Orono (USA). Dept. of Geological Sciences; Fish and Wildlife Service, Laurel, MD (USA). Patuxent Wildlife Research Center). 1982. 144p. NTIS, PC A07/MF A01. File Number DE84901887.

An atlas of predicted sensitivity of aquatic ecosystems to acid rain in the contiguous 48 states in presented. The sensitivities are based on the criteria of Norton (1980). The validity of these maps has been evaluated by field tests in New England for a set of lakes and for streams and flowages. 19 references.

46612 **(NP—4901955) Mechanical harvesting of aquatic plants. Report 3. Evaluation of the Limnos System.** Smith, J.L. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Environmental Lab.). May 1984. 45p. NTIS, PC A03/MF A01. File Number TI84901955.

The Limnos Mechanical Harvesting System consists of a separate cutter machine; a harvester, which includes a gathering and conveyor pickup unit and a processor; and two transport tank barges. System operational tests were conducted on the Withlacoochee River in central Florida during the summer of 1979. Plants harvested were primarily topped-out hydrilla with small amounts of waterhyacinth. Productivity of the cutter unit was evaluated separately and in conjunction with the harvester. Tests were conducted with the harvester with the tank barges to remove the plant material from the water and also without the barges, which allowed the processed plant materials to be discharged directly into the water body. High productivity of the harvester in dense hydrilla (and water-hyacinth mixtures) required reducing the width of cut of the plant material or using 18-ft cuts at two depths (3 and 6 ft). This procedure limited the mass of material that had to be handled by the harvester. Several potential areas requiring additional research

were identified as a result of these tests: improved procedures for evaluating mechanical harvesting machines, and possible improvements to the Limnos harvester system to allow higher productivity. 5 figures, 4 tables.

46613 **(PB—84-192053) Pretreatment and ozonation of cooling tower water: part 1. Technical report.** Krofta, M.; Wang, L.K.; Kurylko, L.; Thayer, A.E. (Lenox Inst. for Research, Inc., MA (USA)). 2 Apr 1983. 36p. NTIS, PC A03/MF A01.

Current technology and research are reviewed concerning the treatment of water for cooling applications. Special emphasis is directed toward the use of ozonation as a water treatment option. Summation includes recommendations for areas of research and proposes components for a laboratory setup designed to test treatment of cooling water by ozonation and other physical-chemical processes, such as flotation and filtration.

46614 **(PB—84-193044) Nitrate removal for small public water systems. Technical report.** (SMC Martin, Inc., Valley Forge, PA (USA)). Jun 1983. 93p. NTIS, PC A05/MF A01.

This Handbook for Nitrate Removal has been prepared to aid water utility owners, engineers, operators, and municipal managers in understanding and dealing with excessive nitrate levels in their water supply. It is intended to be used for defining the problem, developing or evaluating proposed solutions, and explaining to water consumers why nitrates are controlled and what the approximate costs of control will be. This handbook is designed as a technical guide to nitrate removal for those smaller size systems that have decided that nitrate control is desirable. This document contains no regulatory policy and does not obligate systems to use any treatment or nontreatment technique to reduce nitrate concentrations.

46615 **(PB—84-199579) Synthetic resin adsorbents in treatment of industrial waste streams. Final report 1 Jun 80-31 May 82.** Benner, L.S. (Rohm and Haas Co., Spring House, PA (USA)). 1983. 144p. NTIS, PC A07/MF A01.

The use of synthetic polymeric adsorbents for removal of organic pollutants from industrial waste streams is a viable alternative to more common treatment methods such as carbon adsorption. However, resin technology is not widely practiced due to the difficulty of selecting the appropriate synthetic adsorbent/regenerant combination for a particular application. This research program was undertaken to develop a simple, reliable laboratory test to assess the feasibility of using synthetic resin adsorbents for treatment of a given waste water stream. The new test method facilitates rapid screening of a large number of adsorbent/regenerant pairs. The test consists of exposing small bags of adsorbents in the actual waste stream for predetermined periods of time, followed by regenerating the exposed adsorbents. The batch portion of the test measures regenerated saturation capacity of any adsorbent/regenerant pair with a single analysis. The rate portion measures regenerated capacity as a function of time. Capacity data obtained by the test method were compared and correlated with data obtained by conventional isotherm tests and column experiments. In general, the batch test performs better than the isotherm test in predicting column saturation capacity of polymeric adsorbents.

46616 **(USGS-OFR—84-440) Hydrochemical data for the Truckee River drainage system, California and Nevada.** Benson, L.V. (Lawrence Berkeley Lab., CA (USA)). 1984. Contract AC03-76SF00098. 40p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017219.

Surface-water samples were collected from the Truckee River drainage system during 1975, 1976, and 1981. Data resulting from chemical analyses of these samples, as well as certain other previously unpublished data, are tabulated in this report. The report contains the following hydrochemical data: (1) chemical composition of 21 tributaries to Lake Tahoe and the Truckee River upstream from Farad, California (May and October 1971, and June 1972); (2) chemical composition of the Truckee River at Tahoe City (January 1968 to January 1975) and at Farad, California (January 1968 to June 1980), and of the Little Truckee River upstream from Stampede Reservoir, California (January 1968 to April 1980); (3) chemical composition of the Truckee River at 11 sites from Tahoe City, California, to Nixon, Nevada (June 4 and September 3, 1975); (4) historical chemical analyses of water from Pyramid Lake, Nevada (1882 to 1973); (5) chemical composition (November 1975 to December 1976), water temperature (January 1976 to November 1977), and dissolved oxygen (January 1976 to November 1977) at various depths in Pyramid Lake, Nevada; (6) chemical composition of pore fluids from and carbonate mineralogy of sediment greater than 2 micrometers in five cores, Pyramid Lake, Nevada; (7) chemical composition of the Truckee River at Farad, California (January to July 1981); and (8) chemical composition of tufa from the Pyramid Lake basin. 9 references, 3 figures, 14 tables.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 52030045582, 45584, 45588, 45589, 45591, 45592, 45605, 45605, 45648, 45653, 45654, 45655, 45659, 46762

46617 (ARL/TR—060, pp 116-117) **Assessment of radioactivity in the environs of a titanium dioxide plant at Bunbury, Western Australia.** Cooper, M.B.; Williams, G.A. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

Samples of sediment, algae, water and seafood were collected from a titanium dioxide plant's effluent disposal site and from other areas along the coast. Activities due to ^{238}U, ^{226}Ra, ^{210}Pb, ^{228}Ra and ^{228}Th were measured.

46618 **(IAEA-RL—81) Report on intercomparison W-1/2 of the determination of selected radionuclides in fresh water (1980).** Veglia, A.; Dybczynski, R.; Suschny, O. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories). Jul 1981. 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702931.

The report presents results of a laboratory intercomparison of radioactivity measurements in simulated fresh water spiked with the radionuclides ^{3}H, ^{89}Sr, ^{90}Sr, ^{91}Y, ^{95}Zr, ^{106}Ru, ^{137}Cs and ^{144}Ce organized by the Analytical Quality Control Service of the International Atomic Energy Agency during 1980. In total, 108 laboratory means based on 422 individual determinations of 32 laboratories participated in this intercomparison were received. The aim of this intercomparison was to provide laboratories dealing with the determination of low-level activities in water with an opportunity of checking their analytical performance. The high percentages of outliers and the large values obtained for the standard deviations of the accepted results show that more effort is still needed to increase the accuracy of the determination of ^{89}Sr, ^{90}Sr, ^{95}Zr, ^{106}Ru, ^{137}Cs and ^{144}Ce in natural fresh water at the level of pCi/l.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 52040046150

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 52050045710

46619 **(DOE/BP—245) Natural propagation and habitat improvements. Volume 1. Oregon. Supplement B: White River Falls fish passage. Annual report 1983.** (Ott Water Engineers, Inc., Bellevue, WA (USA)). Apr 1984. Contract AC79-83BP13661. 138p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84016392.

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White River Falls are located in north central Oregon approximately 25 miles south of the City of The Dalles. The project site is characterized by a series of three natural waterfalls with a combined fall of 180 ft. In the watershed above the falls are some 120 miles of mainstem habitat and an undetermined amount of tributary stream habitat that could be opened to anadromous fish, if passage is provided around the falls. The purpose of this project is to determine feasibility of passage, select a passage scheme, and

design and construct passage facilities. This report provides information on possible facilities that would pass adult anadromous fish over the White River Falls. 25 references, 29 figures, 12 tables. (ACR)

46620 **(DOE/BP—248) Natural propagation and habitat improvement. Volume III. Idaho. Final and annual reports, 1982/1983.** Espinosa, A. (Clearwater National Forest, Orofino, ID (USA)). Apr 1984. Contract AI79-83BP11980. 352p. NTIS, PC A16/MF A01; 1; GPO Dep. File Number DE84016656.

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In 1983 and under the auspices of the Northwest Power Act, the Clearwater National Forest and Bonneville Power Administration entered into an agreement to improve anadromous fish habitat in three major tributaries of the Clearwater River in Idaho. Phase I (FY 83) habitat enhancement was initiated and completed on Lolo, Crooked Fork, and White Sand Creeks. Enhancement of Lolo Creek involved the placement of 145 structures that were designed to alter the pool/riffle structure, increase diversity and cover, and purge in-stream sediment over 8.5 miles of stream length. Log weirs, organic debris, and boulder clusters were featured in the enhancement design. For the Lolo Project, the average unit cost was $186/structure. Spring chinook salmon was the primary target species and were observed utilizing the enhanced habitat in September. Enhancement of the upper Lochsa River tributaries involved the placement of 263 structures of which 200 were felled riparian trees and 63 were anchored organic debris. Enhancement occurred over 9.1 miles of stream reaches and was designed to increase diversity, cover, and spawning habitat. Depressed stocks of spring chinook salmon and summer steelhead trout were the focal points of the enhancement. The average cost per structure equaled $91/unit. Because of a mixed ownership pattern and in-channel variables, only 50 percent of the total stream distance was available for enhancement. 6 references, 68 figures.

46621 **(PB—84-191626) Ecological impacts of waste water on wetlands: an annotated bibliography.** (Fish and Wildlife Service, Kearneysville, WV (USA). Eastern Energy and Land Use Team). Feb 1984. 339p. NTIS, PC A15/MF A01.

The report is an annotated compilation of references, nationwide, on the ecological effects of waste water addition to wetlands. In addition to over 1000 entries, the document contains an introduction to the ecological issues and bibliographic research methods, a study guide highlighting leading references and an index to subjects, key words and geographical locations.

5206 Regulations

REFER ALSO TO CITATION(S) 52060046588

46622 **(PB—84-187269) Methods and results of EPA's (Environmental Protection Agency's) study of radon in drinking water.** Horton, T.R. (Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility). Dec 1983. 33p. (EPA/520/5—83-027). NTIS, PC A03/MF A01.

In 1978, the Environmental Protection Agency (EPA), through its Eastern Environmental Radiation Facility (EERF), began sampling radon in drinking water. During the next two to three years, approximately 27 states were included in this pilot study, the purpose of which was to determine the need for a nationwide study of radon in drinking water; to demonstrate the feasibility of such a study; and to develop a limited data base of radon in drinking water nationwide. The subject of this paper is the nationwide study that developed from that pilot study. Samples from more than 2500 public water supplies representing 35 states were collected. For the most part, samples were from public groundwater supplies serving 1000 or more people. Although only about five percent of the total number of groundwater supplies in the 48 contiguous states of the U.S. were sampled, those samples represent nearly 45 percent of the water consumed by the U.S. groundwater users in the 48 contiguous states. The intent was to collect samples that represented what people actually consume from a given public groundwater supply.

53 Social And Economic Studies

REFER ALSO TO CITATION(S) 53010046585, 46592

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5501 Behavioral Biology

46623 **Ecology of the redbelly snake (Storeria occipitomaculata) using mesic habitats in South Carolina.** Semlitsch, R.D.; Moran, G.B. (Savannah River Ecology Lab., Aiken, SC). *American Midland Naturalist;* **111**: No. 1, 33-40(Jan 1984). Contract AC09-76SR00819.

The population ecology of the redbelly snake Storeria occipitomaculata from three mesic habitats in South Carolina was studied between 1978-1982. Discrete pulses in seasonal activity were related to the drying cycle of the habitats. Snakes presumably followed their main food resource (slugs) along a soil moisture gradient. Young-of-the-year were first found in July or August and averaged 61 mm snout-vent length (SVL). Testes of males and ovarian follicles of females began to enlarge during their 2nd year at SVLs of 118 mm (males) and 126 mm (females). First reproduction in both sexes presumably occurred at 2 years of age. Mature females contained an average of nine enlarged ovarian follicles. The number of follicles increased with SVL. Males and females were not significantly different in SVL, but females were heavier and males had longer tails. Sex ratio of the sample was 1:1. The authors marked 61 individuals of the 249 that were captured during the study and recaptured four. The low recapture rate suggests that population sizes were large or turnover was rapid. A comparison between life history traits of Storeria occipitomaculata in South Carolina and Michigan showed that body size in South Carolina was smaller at birth and at maturity, but that litter size was slightly larger, than in Michigan. Age at maturity, age at first reproduction and frequency of reproduction were the same in South Carolina and Michigan.

5502 Biochemistry

REFER ALSO TO CITATION(S) 55020046634, 46680

46624 **(BNL—35002) Enzymes and sites of genetic recombination: studies with gene 3 endonuclease of phage T7 and with site affinity mutants of phage λ.** de Massy, B.; Studier, F.; Dorgai, L.; Applebaum, E.; Weisberg, R.A. (National Inst. of Child Health and Human Development, Bethesda, MD (USA). Lab. of Molecular Genetics; Brookhaven National Lab., Upton, NY (USA); Agrigenetics Corp., Madison, WI (USA)). 30 May 1984. Contract AC02-76CH00016. 43p. (CONF-8405223—1). NTIS, PC A03; 3; GPO Dep. File Number DE84015288.

From Cold Spring Harbor symposium on quantitative biology in collaboration with NIH; Cold Spring Harbor, NY, USA (30 May 1984).

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The ability of bacteriophage T7 endonuclease I to cleave Holliday structures was invesigated. Holliday structures are an intermediate in genetic recombination, and their cleavage is essential for bateriophage growth. 37 references, 11 figures.

46625 **(DOE/ER/60015—1) Carcinogen-DNA adducts: linkage site and conformation. Progress report, September 1, 1981-August 31, 1984.** Broyde, S. (New York Univ., NY (USA)). 1984. Contract AC02-81ER60015. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017096.

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Experimental and theoretical results are reported. In the experimental section, the fundamental reaction mechanisms of aromatic amine derivatives were explored as a guide to synthetic efforts. Oligonucleotide-carcinogen adducts were synthesized, and conformational and structural studies carried out. In the theoretical section, atomic resolution views have been generated for a number of AAF and derivative adducts with dCpdG, using minimized potential energy calculations. (ACR)

46626 **(DOE/EV/03490—2113) Comparisons of cytoplasmic and muscle actins in conformational and morphological correlates.** Harwell, O.D. (Rochester Univ., NY (USA)). 1982. Contract AC02-76EV03490. 229p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE84016268.

Portions are illegible in microfiche products; Thesis.

In these studies, skeletal muscle actin has been compared with non-muscle, cytoplasmic actin from bovine brain. The studies include the polymerization and aggregate formation properties of the actins in response to elevated salt concentrations and in response to exposure to various actin modifiers. These morphological changes have been correlated with conformational changes as observed by changes in the electron paramagnetic resonance spectrum of bound spin labels. 160 references, 38 figures, 7 tables.

46627 **(DOE/EV/10326—1) Regulation of nucleic acid and protein synthesis: a background study related to the biological effects of radiation. Progress report.** Zamecnik, P. (Worcester Foundation for Experimental Biology, Shrewsbury, MA (USA)). 1984. Contract AC02-80EV10326. 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017097.

Progress is reported in the following areas in defining the varied roles of diadenosine 5', 5'''-P^1, P^4-tetraphosphate (Ap_4A) in metabolic events within the living cell: (1) Ap_4A association with a subunit of DNA polymerase α; (2) studies on the unusual ordered structure of Ap_4A and of related bisnucleoside oligophosphates; (3) the utilization of technetium labeled Ap_4A as a radionuclide diagnostic reagent; and (4) the role of Ap_4A in the blood clotting mechanism. (ACR)

46628 **Phosphorus-31 and carbon-13 nuclear magnetic resonance studies of divalent cation binding to phosphatidylserine membranes. Use of cobalt as a paramagnetic probe.** McLaughlin, A.C. (Brookhaven National Lab., Upton, New York). *Biochemistry;* **21**: No. 20, 4879-4885(1982).

The paramagnetic divalent cation cobalt has large and well-understood effects on NMR signals from ligands bound in the first coordination sphere, i.e., inner-sphere ligands, and the authors have used these effects to identify divalent cation binding sites at the surface of phosphatidylserine membranes. ^{31}P NMR results show that 13% of the bound cobalt ions are involved in inner-sphere complexes with the phosphodiester group, while ^{13}C NMR results show that 54% of the bound cobalt ions are involved in unidentate inner sphere complexes with the carboxyl group. No evidence is found for cobalt binding to the carbonyl groups, but proton release studies suggest that 32% of the bound cobalt ions are involved in chelate complexes that contain both the carboxyl and the amine groups. All of the bound cobalt ions can thus be accounted for in terms of inner sphere complexes with the phosphodiester group or the carboxyl group. They suggest that the unidentate inner-sphere complex between cobalt and the carboxyl group of phosphatidylserine and the inner-sphere complex between cobalt and the phosphodiester group of phosphatidylserine provide reasonable models for complexes between alkaline earth cations and phosphatidylserine membranes.

5503 Cytology

REFER ALSO TO CITATION(S) 55030046713, 46714, 46715, 46725

46629 **(DOE/EV/03280—T2) Differentiation and carcinogenesis: an integrated multilevel study of mechanisms from molecules to man. Progress report.** (Johns Hopkins Univ., Baltimore, MD (USA). School of Hygiene and Public Health). 1984. Contract AC02-76EV03280. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84015846.

Progress in the following areas is reported: (1) studies on hematopoiesis in bone marrow and spleen cell cultures of Syrian hamsters; (2) development and characterization of in vivo Syrian hamster systems for carcinogenesis studies; (3) development and characterization of in vitro hamster systems for studies of the effect of aging on the neoplastic process; (4) screening and characterization of rodent and human DNA; (5) comparing hyperoxia and γ-irradiation with respect to mutagenesis; (6) monoclonal antibody studies; (7) liposome studies; and (8) preliminary work on development of a model system to study the effects of s-phase interruptions with normal, diploid Syrian hamster cells. (ACR)

46630 **(LA-UR—84-2663) Clonal analysis of bone marrow and macrophage cultures.** Stewart, C.C.; Walker, E.B.; Johnson, C.; Little, R. (Los Alamos National Lab., NM (USA); Washington Univ., St. Louis, MO (USA)). 1984. Contract W-7405-ENG-36. 37p. (CONF-8405232—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE84016464.

From 4. Leiden conference on mononuclear phagocytes; Noordwijk, Netherlands (9 May 1984).

To establish lineages that can be used to study their functional heterogeneity, the proliferation and differentiation of bone marrow derived mononuclear phagocytes and the lineages derived from them were studied. 28 references, 7 figures, 5 tables. (ACR)

46631 **(LALP—84-42) Toward a cell-culture model of cancer.** Kraemer, P.M. (Los Alamos National Lab., NM (USA)). Aug 1984. Contract W-7405-ENG-36. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017106.

Los Alamos Mini-Review.

The spontaneous transformation of normal Chinese hamster cells into malignant cells was studied. Hamster cells when grown in culture over an extended series of subcultivations inevitably become malignant even without exposure to a carcinogen. The study of this process using flow cytometry and the implantation of cultured cells into retrievable sponges placed under the skin of a nude mouse is described. (ACR)

46632 **Flow cytometry.** Steinkamp, J.A. (Experimental Pathology, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Review of Scientific Instruments;* **55**: No. 9, 1375-1400(Sep 1984).

Flow cytometry instrumentation developed from early efforts to count cells and particles in liquid suspension as they passed through a sensing device. Since the mid-1960's sophisticated instruments have been designed for analyzing cells based on various cytological, biochemical, and functional properties. These instruments have revolutionized automated cell analysis methods in that measurements are made at high speed, multiparameter data is correlated on each cell, statistical precision is high, and cells are separated in high purity from heterogeneous mixtures for identification and functional analysis. Advanced instruments capable of measuring cell volume, surface area, multicolor fluorescence, fluorescence polarization, light scatter within various angular regions, and axial light loss (extinction) at different wavelengths are being used in biomedical research for analyzing and sorting normal and abnormal cell populations. This article reviews the development of flow cytometers, the conceptual basis of flow measurements, and discusses some of the numerous applications of the technology in biology and medicine.

46633 **Increasing the levels of ether-linked lipids in L-M cells by glyceryl ether supplementation depresses growth and choline utilization.** Cabot, M.C.; Welsh, C.J.; Snyder, F. (Oak Ridge Associated Universities, TN). *Biochimica et Biophysica Acta;* **713**: 16-22(1982). Contract AC05-76OR00033.

To gain insight into the role of alkyl-linked lipids in biolgical systems, the authors added hexadecylglycerol (a precursor of complex ether-linked lipids) to medium required for the growth of L-M cells in culture. L-M fibroblasts cultured through several generations in the presence of hexadecylglycerol grow at a reduced rate. Hexadecylglycerol (10 μg/ml) added 1 day after cell passage does not retard growth; however, within 1 h it decreases the incorporation of choline into the choline glycerophosphatide fraction. Inhibition is specific for choline. The inhibition of choline utilization by hexadecylglycerol-treated cells is dose-dependent and reaches a maximum 12 h after supplementation. Cellular uptake of choline is reduced but not as much as the incorporation of choline into the phospholipids. The assimilation of ether lipid precursor into cellular phospholipids was followed by incubating cells with [1-^{14}C]hexadecylglycerol. Incorporation of radioactivity into cellular phospholipids begins to plateau after 24 h, whereas the interference of hexadecylglycerol with choline metabolism could be detected as early as 1 h. These results show that the supplementation of a glyceryl ether to L-M fibroblast growth media selectively inhibits the utilization of choline for choline glycerophospholipid biosynthesis and causes a reduction in cell growth rate when cells are continually passaged in the presence of the glyceryl ether.

5504 Genetics

REFER ALSO TO CITATION(S) 55040046624, 46669

46634 **Mechanism of suppression in Drosophila: evidence for a macromolecule produced by the su(s)$^+$ locus that inhibits sepiapterin synthase.** Jacobson, K.B.; Yim, J.J.; Grell, E.H.; Wobbe, C.R. (Oak Ridge National Lab., TN). *Cell;* **30**: 817-823(Oct 1982).

Genetic suppression was studied in the purple mutant of Drosophila melanogaster and in suppressed purple by measurement of sepiapterin synthase activity. The addition of ammonium sulfate fractions from adult Drosophila that contain one, two, three or four doses of su(s)$^+$ to the suppressed purple sepiapterin synthase resulted in an inhibition that increased progressively as the dosage of su(s)$^+$ increased; the wild-type sepiapterin synthase was not inhibited. This inhibition is caused by a heat-labile macromolecule. The authors suggest that the mechanism of suppression is neither transcriptional nor translational but is the result of decreased amounts, or altered properties, of the normal product of the su(s)$^+$ locus.

46635 **Novobiocin resistance marker in Haemophilus influenzae that is not expressed on a plasmid.** Setlow, J.K.; McCarthy, D.; Clayton, N.L. (Brookhaven National Lab., Upton, NY). *Journal of Bacteriology;* **151**: No. 3, 1358-1362(Sep 1982).

The plasmid pNov2, carrying a cloned chromosomal marker conferring resistance to at least 2.5 μg of novobiocin per ml, was constructed with a new Haemophilus influenzae cloning vehicle, pDM2. The novobiocin marker of pNov2 was not normally expressed, but in Rec$^+$ cells approximately one in 10^4 cells in a culture of a transformant became novobiocin resistant, a frequency about four orders of magnitude higher than the spontaneous mutation frequency. Variants of such cells that had lost the plasmid were also novobiocin resistant. Since Rec$^-$ cultures bearing pNov2 showed novobiocin resistance only at the normal mutation frequency, the authors concluded that the Rec$^+$ novobiocin-resistant transformants arose because of a rare recombination between plasmid and chromosome. Evidence is presented that novobiocin sensitivity is dominant over this particular novobiocin resistance marker.

46636 **Plasmid-conferred tetracycline resistance confers collateral cadmium sensitivity to E. coli cells.** Griffith, J.K.; Buckingham, J.M.; Hanners, J.L.; Hildebrand, C.E.; Walters, R.A. (Los Alamos National Lab., NM). *Plasmid;* **8**: 86-88(1982).

E. coli HB101 cells transformed to tetracycline resistance with the plasmids pMB9 or pBR322 display a 10^5-10^6-fold lower plating efficiency on agar containing 440 μM $CdCl_2$ than nontransformed cells. When DNA is inserted into the BamH1 site of the plasmid tet gene, or when DNA spanning the BamH1 site is deleted, tetracycline resistance and cadmium hypersensitivity are both lost. In contrast, insertion of DNA into the ampicillin resistance gene does not affect cadmium hypersensitivity.

5505 Metabolism

REFER ALSO TO CITATION(S) 55050046332, 46652, 46718

46637 **(ARL/TR—060, pp 83-84) Particulate preparations excreted by the body.** Pojer, P.M.; Spokas, R.J. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

In mice, labelled Raney nickel accumulated in the lungs and liver and remained there. Nickel and cobalt borides were initially filtered by these organs but soon the activity dispersed throughout the body. In the rabbit the dispersal was slower.

46638 **(LBL—18005) Control of carbon metabolism at phosphoenolpyruvate in photosynthetic cells.** Bassham, J.A. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 39p. (CONF-8404185—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84015742.

From Japanese Society of Plant Physiologists meeting; Kanazawa, Japan (2 Apr 1984).

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The alteration of gene expression to increase productivity of plants is discussed. Such changes could be used to control the amounts and activities of enzymes which mediate key rate-limiting steps in carbon and nitrogen metabolism. One possibility would be the carbon metabolism associated with reactions using and forming phosphoenolpyruvate (PEP). This metabolite is found in both chloroplasts and cytoplasm, is involved in C_4 metabolism, and respiratory metabolism, and occupies a central position from which several biosynthetic pathways begin. Control of PEP metabolism is discussed. 40 references, 14 figures. (MF)

46639 **Magnetic characterization of the primary state of bacterial photosynthesis.** Norris, J.R.; Bowman, M.K.; Budil, D.E.; Tang, J.; Wraight, C.A.; Closs, G.L. (Argonne National Lab., IL). *Proceedings of the National Academy of Sciences of the United States of America;* **79**: 5532-5536(Sep 1982). Contract W-31-109-ENG-38.

The results of reaction yield-detected magnetic resonance (RYDMR) experiments carried out on modified bacterial photosynthetic reaction centers (RCs) are interpreted in terms of a model that assigns the initial charge-separated radical ion-pair state, P/sup F/, as the carrier of the spectrum. The radical pair theory, which has been invoked to explain magnetic field effects in RCs, was significantly expanded to take into consideration the electron dipole-dipole interaction. It is shown that this is the largest interaction between the components of the radical ion pair. Quantum statistical calculations are described simulating the RYDMR spectra and low-field effects in quinone-depleted RCs. It was found possible to characterize P/sup F/ in terms of four parameters, two containing structural information and two with kinetic implications. The structural and dynamic implications of these parameters are discussed.

5506 Medicine

REFER ALSO TO CITATION(S) 55060045669, 46474, 46498, 46627, 46670, 46682, 46717

46640 **(AECL—7680) MONTE and ANAL1. A general purpose Monte Carlo simulation for the design of single-slice positron emission tomography ring cameras.** Lupton, L.R.; Keller, N.A. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Sep 1982. 53p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84702945.

The design of a positron emission tomography (PET) ring camera involves trade-offs between such things as sensitivity, resolution and cost. As a design aid, a Monte Carlo simulation of a single-ring camera system has been developed. The model includes a source-filled phantom, collimators, detectors, and optional shadow shields and inter-crystal septa. Individual gamma rays are tracked within the system materials until they escape, are absorbed, or are detected. Compton and photelectric interactions are modelled. All system dimensions are variable within the computation. Coincidence and singles data are recorded according to type (true or scattered), annihilation origin, and detected energy. Photon fluxes at various points of interest, such as the edge of the phantom and the collimator, are available. This report reviews the basics of PET, describes the physics involved in the simulation, and provides detailed outlines of the routines.

46641 (ARL/TR—060, pp 79) **Myocardial uptake of N-substituted thiourea complexes of technetium-99m.** Baldas, J.; Bonnyman, J. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

46642 (ARL/TR—060, pp 80) **Technetium-99m based radiopharmaceutical for gastrointestinal scintigraphy.** Jakovljevic, A.C.; Pojer, P.M.; Spokas, R.J. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

46643 (ARL/TR—060, pp 55-57) **X-ray imaging using multiwire proportional counters.** Thomson, J.E.M.; Forgione, F.A.; Webb, D.V. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

The application of multiwire proportional counters to X-ray imaging in medicine is being investigated. The prototype system is capable of either standard two dimensional radiological images or axial tomographs using soft X-rays. In both modes the system has demonstrated a resolution of about 500 micron.

46644 (DOE/ER/60029—3) **Development of methods and instruments for noninvasive magnetopneumography of coal mine dust in the lungs of coal workers. Progress report, September 15, 1983-September 14, 1984.** Freedman, A.P.; Robinson, S.E. (Hahnemann Univ. Hospital, Philadelphia, PA (USA)). Aug 1984. Contract AC02-81ER60029. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017031.

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Progress was made in improved magnetometer sensors, fabrication of printed circuit boards for instrumentation, start of construction of new MPG scanner, improved mathematical solution for lung dust from MPG measurements, improved techniques for measuring lungs clearance by MPG. The instrumentation package for field portable magnetopneumography is nearly complete. This package consists of five two-axis low-noise fluxgate magnetometer sensors and their support electronics, a microprocessor controller, and a capacitive-discharge electromagnet power supply. These electronics have been designed to interface with a portable MPG scanner for non-invasive determination of coal mine dust and coal fly ash in the lungs of workers. After successful construction of prototype magnetometers, printed circuit boards have been fabricated for the electronics to be used in the field. The fluxgate sensor noise, previously reported by us to range from 10.1 to 18.9 pT rms per root Hz (dc to 10 Hz bandwidth), has been improved considerably after rewinding and reannealing sensor cores. A typical noise performance of 4 to 6 pT rms per root Hz (same bandwidth) is now seen. 5 figures.

46645 (DOE/ER/60033—5) **Nuclear medicine and imaging research. Instrumentation and quantitative methods of evaluation. Progress report, January 15, 1984-January 14, 1985.** Beck, R.N.; Cooper, M.D. (Franklin McLean Memorial Research Inst., Chicago, IL (USA)). Sep 1984. Contract AC02-82ER60033. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017426.

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This program addresses problems involving the basic science and technology of radioactive tracer methods as they relate to nuclear medicine and imaging. The broad goal is to develop new instruments and methods for image formation, processing, quantitation and display, so as to maximize the diagnostic information per unit of absorbed radiation dose to the patient. Project I addresses problems associated with the quantitative imaging of single-photon emitters; Project II addresses similar problems associated with the quantitative imaging of positron emitters; Project III addresses methodological problems associated with the quantitative evaluation of the efficacy of diagnostic imaging procedures.

46646 (DOE/ER/60175—T1) **Synthesis of new bifunctional chelating agents. Progress report.** Liang, F.H.; Hnatowich, D.J. (Massachusetts Univ., Worcester (USA). Dept. of Nuclear Medicine). Jun 1984. Contract AC02-83ER60175. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016801.

In the effort to label biologically active molecules with radioactive metals for imaging, attempts have been made to synthesize new bifunctional chelating agents that retain high chelating capability and specific biological activity. Compounds structurally related to ethylenediaminetetraacetic acid (EDTA) are expected to retain high chelating power. The following two types of compounds, diaminodiphenol (DADP) and diaminodithiol (DADT) were chosen for synthesis in this study. 15 references. (ACR)

46647 (DOE/EV/10402—T3) **Positron ring system using Anger-type detectors. Progress report for period ending December 31, 1984.** Muehllehner, G. (Pennsylvania Univ., Philadelphia (USA)). Aug 1984. Contract AC02-80EV10402. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84016788.

A single-ring positron camera consisting of six position-sensitive single-crystal detectors has been constructed, and its performance has been evaluated for a variety of applications. The major factors limiting its performance have been established, and methods to overcome some of these limitations have been explored. At low data rates, a spatial resolution of 6.5 mm full-width-half-maximum (FWHM) has been measured in the final reconstructed image, and at high data rates a spatial resolution below 8 mm FWHM has been achieved. Initial problems in imaging extended objects have been overcome through careful normalization of the data and by using an iterative reconstruction algorithm which is insensitive to the missing data due to the gaps between the detectors. 10 figures.

46648 (INIS-mf—8786) **Comparative studies on virus detection in acute respiratory diseases in humans by means of RIA and cultivation.** Ehrlicher, L. (Freie Univ. Berlin (Germany, F.R.)). 14 Jul 1982. 73p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE84780593.

In winter 1981, 146 patients with an acute respiratory infection were examined. Nasopharyngeal specimens were obtained by intranasal catheter. Comparative investigations were performed by cultivation in tissue culture and by a four-layer radioimmunoassay. In the radioimmunoassay, polystyrene beads were used as the solid phase, ginea pig antivirus immunoglobulins as the captive antibodies, rabbit anti-virus immunoglobulins as the secondary antibodies and ^{125}I-labelled sheep anti-rabbit immunoglobulins were used as the indicator antibodies. The radioimmunoassay was developed for the detection of adenovirus, respiratory syncytial virus, influenza A and B virus and parainfluenza type 1, type 2 and type 3 virus. Tissue culture seems to be more sensitive for detection of adenovirus and influenza A virus, though some infections with influenza A virus could only be diagnosed by the radioimmunoassay. In other cases (respiratory syncytial virus, influenza B virus) antigen detection by radioimmunoassay is more efficient. Presently the combination of both antigen-detection-systems still is the optimal diagnostic procedure for detecting virus infections of the respiratory tract.

46649 (INIS-mf—8791) **Experimental and clinical investigations of a TSH radioimmunoassay.** Offenberger, P. (Giessen Univ. (Germany, F.R.). Fachbereich Humanmedizin). 1979. 81p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84780594.

The system hypothalamus-pituitary-thyroid was studied in 427 patients by radioimmunological TSH determination prior to i.v. injection of 600 µg of synthetic TSH and 30 min p.i. Different commercial TSH test kits were used. The RIA was found to be a sensitive indicator of the functional state of the system. Higher accuracy can be achieved by observing certain criteria. The TSH-RIA is a valuable tool for diagnosis and therapy control of thyroid diseases. With some slight methodological modifications, it has become part of the routine programme of the Giessen thyroid laboratory. The RIA is best suited for early detection of disturbances in the pituitary-thyroid system; it is less efficient in course control of thyroid diseases. It can be carried out within 30 minutes and, except for two withdrawals of blood, imposes no strain on the patient.

46650 **(INIS-mf—8792) Clinical symptoms, diagnosis and course of chronic T-cell-type lymphadenosis.** Becher, C. (Muenchen Univ. (Germany, F.R.)). 15 Jul 1982. 78p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84780601.

The clinical course of T-lymphadenosis is illustrated by the example of 5 patients and compared with the case studies in relevant publications. The latency period between initial anamnesis and diagnosis was 4 to 6 months, the patients' mean age 65 years, and the male/female ratio 4:1. Of the clinical symptoms, splenomegaly was observed in 80% of all cases, while the lymph nodes were only slightly enlarged in 46% of the cases. One third of the patients presented with diffuse, erythroderma-type skin infiltrations with lymphatic elements. Of the hematological findings, excessive leukocytosis with an average of 300 000/µl and a lymphocyte fraction of 93% was the most frequent. Detailed information can be obtained by immunological lymphocyte differentiation. The disease is rapidly progressive, with an exponential lymphocyte growth rate. The individual lymphocyte doubling time is well correlated with the forecasts. Both chemotherapy and radiotherapy require high doses and have no significant effect on the course of the disease. The mean survival time after diagnosis is 8.1 mon. Differential diagnosis is made possible by the cytochemical and immunological cell parameters described.

46651 **(INIS-mf—8795) Catamnestic studies of radiosurgical combination therapy of advanced carcinoma of the larynx.** Meyer-Breiting, P. (Frankfurt Univ. (Germany, F.R.). Fachbereich Humanmedizin). 28 Jul 1981. 129p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84780602.

The first part of the study summarizes the post-therapeutical course of development of 165 patients who have been treated for advanced internal and external carcinoma of the larynx with a combined, pre- or postoperative radiosurgical therapy, with particular attention being paid to the frequency of focal or lymph node recidivation, post-therapeutical apparent distant metastases and postoperative complications, and also to tumour-independent mortality. The second part of the study is concerned with the determination of survival rates of patients suffering from advanced carcinoma of the larynx or hypopharynx, following low-dose preoperative irradiation (119 patients) or postoperative irradiation (209 patients).

46652 **(INIS-mf—8799) Determination of the uptake rates of the bone for 99m-Tc-methylendiphosphonate by means of gamma-camera-scintiscanning and checking its diagnostic value for various skeleton diseases.** Scholz, J.M.Q. (Hamburg Univ. (Germany, F.R.). Fachbereich Medizin). 3 Feb 1982. 60p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE84780595.

A model of uptake of labelled phosphate in the bones was used to derive a method of calculating the uptake rates for 99m-Tc-MDP. The precondition was the measurement of the change in radioactivity by means of a gamma camera within the lumbal part of the spine over 1 hour. The method was applied on 49 patients (7 with healthy bones, 6 cases of hyperparathyreoidism, 10 of osteoprosis, 9 cases of osteomalacia, 1 case of hypoparathyreoidism, 10 cases of ankylosing spondylitis, 6 tumours affecting the skeleton). Osteomalacia, ankylosing spondylitis, tumours, and, in 50% of the cases, hyperparathyreoidism could be differentiated from normal findings more significantly than using conventional scintiscanning. The author's expectations were met by the method. It is suitable for diagnosing metabolic osteopathis and controlling therapy in circumscribed bone foci.

46653 **(INIS-mf—8801) Quantitative skeletal scintiscanning of the skull with Tc-99m-Sn-pyrophosphate on patients with squamous cell carcinoma in the region of the paranasal sinuses and the base of the skull.** Prestel, G. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 26 Nov 1981. 125p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84780596.

Scinticans and tomographs in frontal and lateral projection were made before, during, and after the disease on 22 patients with squamous cell carcinomas in the region of the paranasal sinuses and the base of the skull. For all patients, treatment consisted in a radiotherapy with gamma or ultra-hard X-rays; in half the number of the patients, the tumour was eliminated by surgery before irradiation. The majority of squamous cell carcinomas which were not operated reduced their activity after radiotherapy. This reduction of activity appeared both in a spontaneous reaction immediately after the finishing of the radiation and in a process lasting over years. After removal of the tumour by surgery the maximal values measured in the tumour centre nearly all dropped to values which were not pathological. In the peripheral regions of the operation area, however, extremely increased activity was seen which was a sign for the bone changes induced by the operation. The appearance of new foci in course control can be regarded as an indication of a relapse and is of importance for the exact tomographic checking and for the site of a test excision. Thus scintiscanning evaluated quantitatively is a valuable complementary method for X-ray diagnosis and the clinical course control.

46654 **(INIS-mf—8809) In vivo determination of the thyroid volume: comparison of existing and new nuclear-medical methods using a sonographic reference method.** Lukas, P. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 20 Oct 1981. 73p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE84780597.

Using a sonographic reference method which helps to determine the volumes of small parenchymatous organs with a maximum error rate of +- 11.8%, conventional and new methods of determining the volume of the thyroid were compared with reference to 101 cases. The most frequently used method of determining the volume of the thyroid with the help of palpation with additional scintigraphy was the one which correlated least with the reference method: r = 0.78, average error rate +- 34%; very small thyroids were often overestimated, bigger thyroids were always underestimated. Only slightly better results were obtained by methods which are based on data obtained from the scintiscan.

46655 **(INIS-mf—8812) Post-operative radiotherapy of carcinoma of the bladder.** Heidrich, V. (Marburg Univ. (Germany, F.R.). Fachbereich Humanmedizin). 23 Oct 1981. 45p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84780603.

The results of 330 tumours of the bladder treated in the Marburg Radiological Clinic from 1957 until 1977 are evaluated. Of these 330 patients, 227 were male, 53 female. The average age at the beginning of the treatment was 65,25 years. As irradiation methods, we chose vertical and pendulum irradiation with a telegamma equipment (Gammatron I, Siemens). The equipment was programmed to 60 Gy in a 5-day rhythm with single doses of 1.5 Gy. The fractioning of the focal dose used leads, in addition to an increased curability, also to an improved tolerance: in only 3.03% of the cases severe side effects are seen in the form of radiovasculopathy and necrotising radiocystitis resp. which necessitate a cystectomy. The percentage of the total range of side effects (22.7%) could also be reduced considerably. The survival rate was 69.4% after one year, 35.4% after 3 years, and 25.6% after five years. There was a direct relation between the rates of survival and the focal dose. Within the gammatron technique, the three-fields-method was found to be slightly superior to the pendulum and the wedge filter methods.

46656 **(INIS-mf—8841) Preoperative irradiation of hypernephroid carcinoma. A retrospective investigation in 178 patients.** Akbar, D. (Freie Univ. Berlin (Germany, F.R.). Medizinische Fakultaet). 3 Mar 1982. 44p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE84780604.

Since 1969, preoperative irradiation of hypernephroid carcinoma has been a routine measure at the Steglitz medical clinic: It consists in the application of a focal dose of 30 Gy, fractionated into doses of 2.5 Gy, as Betatron pendulum irradiation (42 MeV photons) covering the para-aortic lymph nodes. After a treatment-free interval of 3 weeks, radical nephrectomy is carried through. Of 178 patients, 47 were in tumor stage I, 15 in stage II, 83 in stage III and 33 in stage IV. In 99 patients the treatment dated back longer than 5 years; the survival rate was 52%. 67% of the patients had survived longer than 3 years. Operation lethality was 3%. The preoperative irradiation pursues the following aims: 1. Devitalization of potentially proliferating cells in the tumor periphery, and thus prevention of displaced tumor cells growing on and postoperative local recidivations; 2. Shrinking of the tumor, facilitating the surgical intervention. In a third of the cases a measurable alteration of the tumor was confirmed by X-ray. The low operation lethality of 3% is attributed to this.

46657 **(INIS-mf—8850) Determination of the liver clearance of ^{131}I-bromosulfophthalein with partially shielded whole-body counter - method and clinical results.** Heyder, R. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Medizin). 23 Oct 1980. 113p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84780598.

The aim of the study consisted first of all in working out a procedure to determine the liver clearance of ^{131}I-bromosulfophthalein according to the Oberhausen method and to inquire into the usability and sphere of validity of the Oberhausen approach. Subsequently a collective of patients was to be tested in order to find out whether it is possible with the aid of the clearance value to differentiate between persons with healthy livers and persons with liver disturbances respectively to assess the severity of a functional liver disorder. As the investigations were carried through as a part of the clinical routine, the information obtained by the clearance concept as compared to sequential scintiscanning and compartment analysis was to be investigated at the same time.

46658 **(INIS-mf—8851) Comparison of surgical, radiation and cytostatic treatment of gastric carcinomas in world literature from 1973 to 1978.** Delcker, A. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Medizinische Fakultaet). 17 May 1982. 96p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84780605.

Among the three possible therapeutic methods, surgical treatment gives the best results from a three-year survival time onwards. The five-year survival rate is between 8 and 18.6 pc. With radiation therapy the survival rate is already at 8.3 pc after three years. In cases of cytostatic treatment of locally restricted tumors, the rate of survival three years after the inception of the therapy is zero. The one-year survival rate with additional cytostatic treatment is 73.9 pc, without it there are 46.7 pc survivals. Surgery plus radiation therapy accounts for a one-year survival rate of 55.5 pc. This is more than with surgery alone (33 pc respectively 46.7 pc), but less than the one-year survival rate for surgical and cytostatic treatment (73.9 pc). Where radiation plus chemical therapy is applied, the percentage of survivals after two years is 28.5, respectively 40 for local tumors. None of the patients with metastases had survived two years after the treatment was started. (Comparison with surgery alone: five-year survival rate 9.4 pc of patients with affected lymph nodes). The best results are obtained by surgical combined with cytostatic treatment, possibly also by surgery in combination with radiation therapy.

46659 **(INIS-mf—8852) ^{133}Xenon muscle clearance as a test parameter in the diagnosis of peripheral diabetic angiopathies.** Kuhlmann, J.E. (Muenchen Univ. (Germany, F.R.). Fachbereich Medizin). 24 Jun 1980. 103p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84780599.

In 100 patients with manifest diabetes mellitus the irrigation in both legs at rest and in radioactive hyperemia after ischemic muscle work was measured by means of the 133-xenon muscle clearance. The clearance values measured ranged between 0.8 and 3.5 ml/100 g/60 s at rest and between 3.3 and 40.0 ml/100 gl/60 s during radioactive hyperemia. In 96 pc of the probands the irrigation of the legs was impaired. For the relation between glucose level and irrigation at rest a significant negative correlation was found. The difference between the clearance values for the right and left lower extremity was significant. For the relation between glucose level and reactive hyperemia, too, a significant negative correlation was found. The difference between the clearance values for the right and left lower extremities was significant. The measurement of the irrigation at rest showed no significant correlation between the period of manifestation of the diabetes and the clearance values. By contrast, the irrigation values during reactive hyperemia were shown to be in significantly negative correlation to the duration of the diabetes. No connection was found between the frequency of diabetic gangrene and impaired irrigation at rest. By contrast, there was a relation between decreasing hyperemia values and increased frequency of gangrene. A collection of case histories shows how the measuring results of the xenon clearance fit into the overall clinical picture. A comparison of xenon clearance with other methods of irrigation measurement confirmed obvious advantages of xenon clearance for the detection of diabetic microangiopathies.

46660 **(INIS-mf—9050) Single photon emission computerized tomography. Some theoretical considerations and clinical applications.** Hooge, P. de. (Rijksuniversiteit Utrecht (Netherlands)). 25 Oct 1983. 316p. (In Dutch). NTIS (US Sales Only), PC A14/MF A01. File Number DE84780600.

In this thesis two single-photon emission tomographic techniques are presented: (a) longitudinal tomography with a rotating slanting-hole collimator, and (b) transversal tomography with a rotating gamma camera. These methods overcome the disadvantages of conventional scintigraphy. Both detection systems and the image construction methods are explained and comparisons with conventional scintigraphy are drawn. One chapter is dedicated to the determination of system parameters like spatial resolution, contrast, detector uniformity, and size of the object, by phantom studies. In separate chapters the results are presented of detection of tumors and metastases in the liver and the liver hilus; skeletal diseases; various pathological aberrations of the brain; and myocardial perfusion. The possible use of these two ect's for other organs and body areas is discussed in the last chapter.

46661 **(LA-UR—84-2499) Isotopic analysis of dimethyl selenide.** McInteer, B.B. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 9p. (CONF-8406146—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016481.

From 2. international conference on mass spectrometry and gas chromatography in biomedical sciences; Milan, Italy (18 Jun 1984).

Portions are illegible in microfiche products.

The separated isotopes of selenium may be used as stable precursors for the synthesis of radio-bromine isotopes for positron emitter tomographic diagnostics. As part of a project to find a suitable distillation method for separating selenium isotopes, the need arose to study the organo-metallic compound dimethyl selenide. The complexity of the mass spectrum tended to obscure the isotope effect with 35 major peaks being measured. A least-squares fitting procedure was developed for the 13 fragmentation factors as well as a few hundredths of a percent, yet no sizeable separation was observed across the test column. According to these measurements, the effect of one mass unit increase in the selenium isotope results in less than 10 ppM in the vapor pressure of the compound. 4 figures.

46662 **(OTA-HCS—24) Variations in hospital length of stay: their relationship to health outcomes.** Chassin, M.R. (Office of Technology Assessment (U.S. Congress), Washington, DC). Aug 1983. 138p. GPO*. File Number TI84901861.

Eastern hospitals exhibit lengths of stay that are about 40 percent higher than western hospitals. These differences have remained remarkably consistent over the past 15 years. They are un-

explained by differences among regions in age, sex, or race distributions. Current research has also been unable to demonstrate that differences in severity of illness across regions explain any of the variations. Available evidence suggests that physicians in different regions treat patients with the same illnesses differently with respect to LOS. This case study attempted to find data in the medical research literature clearly establishing a particular LOS for specific illnesses that produces the best health outcome. Studies with scientifically sound methods were found in five clinical areas: acute myocardial infarction, elective surgery, low risk newborn deliveries, low birth weight infants, and psychiatric hospitalization. Studies in the first four areas uniformly concluded that shorter lengths of stay had no different outcomes from the more traditional, longer lengths of stay. The medical literature failed to establish clear LOS standards for any clinical condition. Further research will be necessary to establish the relationship between length of hospital stay and health outcomes. 185 references, 5 figures, 18 tables.

46663 **New fast algorithm for the evaluation of regions of interest and statistical uncertainty in computed tomography.** Huesman, R.H. (California Univ., Berkeley (USA). Donner Lab.; Lawrence Berkeley Lab., CA (USA)). *Physics in Medicine and Biology;* **29**: No. 5, 543-552(May 1984).

A new algorithm for region of interest evaluation in computed tomography is described. Region of interest evaluation is a technique used to improve quantitation of the tomographic imaging process by summing (or averaging) the reconstructed quantity throughout a volume of particular significance. An important application of this procedure arises in the analysis of dynamic emission computed tomographic data, in which the uptake and clearance of radiotracers are used to determine the blood flow and/or physiological function of tissue within the significant volume. The new algorithm replaces the conventional technique of repeated image reconstructions with one in which projected regions are convolved and then used to form multiple vector inner products with the raw tomographic data sets. Quantitation of regions of interest is made without the need for reconstruction of tomographic images. The computational advantage of the new algorithm over conventional methods is between factors of 20 and of 500 for typical applications encountered in medical science studies. The greatest benefit is the ease with which the statistical uncertainty of the result is computed. The entire covariance matrix for the evaluation of regions of interest can be calculated with relatively few operations.

46664 **Synthesis and evaluation of radioiodinated (E)-18-iodo-17-octadecenoic acid as a model iodoalkenyl fatty acid for myocardial imaging.** Knapp, F.F. Jr.; Goodman, M.M.; Kabalka, G.W.; Sastry, K.A. (Oak Ridge National Lab., TN). *Journal of Medicinal Chemistry;* **27**: No. 1, 94-97(Jan 1984).

^{125}I-labeled (E)-18-iodo-17-octadecenoic acid (13) has been prepared and evaluated in rats to determine the myocardial uptake and retention and degree of in vivo deiodination of this model iodovinyl-substituted fatty acid, which contains no structural perturbation to inhibit metabolism. This new agent was prepared by NaI-chloramine-T treatment of (17-carbomethoxyheptadec-1-en-1-yl)boronic acid (11) prepared by catecholborane treatment of methyl 17-octadecynoate (10), followed by basic hydrolysis to the free acid (13). The pivotal substrate, 17-octadecynoic acid (9), was prepared by two new routes. The ^{125}I-labeled acid 13 showed high myocardial uptake (1 h, 1.90-2.28% dose/g) with 45% washout after 2 h but lower heart/blood ratios in comparison to analogues containing the tellurium heteroatom. Deiodination was low for the first 2 h after injection (2 h, 61% dose/g). Excellent myocardial images were obtained in a dog with the ^{123}I-labeled agent.

5507 Microbiology

REFER ALSO TO CITATION(S) 55070046624, 46635, 46639

46665 **(NP—4901953) Compatibility and infectivity of a Cercospora rodmanii formulation with enhancing agents. Final report.** Pennington, J.C.; Theriot, E.A. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Environmental Lab.). Jun 1983. 27p. NTIS, PC A03/MF A01. File Number TI84901953.

A formulation of the fungus Cercospora rodmanii Conway has been produced, as a biocontrol of waterhyacinth (Eichhornia crassipes (Mart.) Solms.). To ensure the most efficient germination of the formulation, 12 potential enhancing agents were tested for addition during the spray application. The agents were aspartic acid, glucose, glutamic acid, gum xanthan, nutrient agar, Ortho X-77 Spreader, Tween 20, Tween 60, Tween 80, sodium alginate, Super Slupper, and yeast extract. Compatibility of test agents and combinations of test agents with two lots of the formulation was determined in the laboratory. All combinations of test agents were compatible with both lots of the C. rodmanii formulation. The C. rodmanii formulation was sprayed with test agents on waterhyacinth pseudolaminae. Damage was monitored each week for 8 weeks by assigning a disease index to each original and new pseudolaminae. No spots having characteristics suggestive of C. rodmanii infection were observed at any time during the study. Lack of infectivity could be remedied by isolating a virulent strain of C. rodmanii from the field. Agents determined to be compatible in this study could then be reexamined for enhancing infectivity on a virulent C. rodmanii formulation. 14 references, 2 figures, 5 tables.

46666 (SERI/CP—231-2292, pp 1-3) **Study of methanogens by genetic techniques.** Baresi, L.; Bertani, G. (Jet Propulsion Lab., Pasadena, CA). Jul 1984. NTIS, PC A07/MF A01. File Number TI84013021.

In Fuel gas production from animal and agricultural residue and biomass. Contractors review meeting, December 6, 1983.

Detailed knowledge of the genes involved in methanogenesis could have an impact on the ability to regulate production of methane. The objective of this continuing research effort is to define a genetic system in methanogenic bacteria. In the second year of this effort JPL has continued to induce and to isolate mutants of methanogenic bacteria, to characterize some of these mutants, to attempt DNA transfer experiments and to search for bacteriophage active on methanogenic bacteria. The objective of the third year's work will be to continue this work concentrating on bacteriophage/host characterization. 1 reference.

46667 (SERI/CP—231-2292, pp 4-66) **Physiology and biochemistry of the interactions of methanogenic bacteria with fatty acid producers and utilizers as an approach to increasing the rate and yield of methanogenesis.** Le Gall, J.; Nacro, M.; He, S.H. (Univ. of Georgia, Athens). Jul 1984. NTIS, PC A07/MF A01. File Number TI84013021.

In Fuel gas production from animal and agricultural residue and biomass. Contractors review meeting, December 6, 1983.

The physiology and biochemistry studies of the interactions of methanogenic bacteria with fatty acid producers and utilizers have been in progress since 1981. The overall objective of the project is to determine the best conditions of recovering methane through anaerobic degradation of cellulosic biopolymers. Based upon the consideration that the natural anaerobic degradation of cellulosic biopolymers to methane and carbon dioxide is a complete food chain, the project was developed in order to: (1) isolate the bacteria involved in the process especially the fatty acid producers and utilizers, the acetogenic sulfate reducing bacteria and the acetate utilizing methanogen; (2) study the nutritional and environmental parameters for these bacteria; and (3) study their enzymatic system in relation with their interactions with one another. The following statements summarize the research conducted during the period October 1982 to October 1983. (1) Microbiology - the isolation of microorganisms will be finished and the new organisms fully characterized. (2) Nutritional study - the study of metal requirement (Ni, Co, Mo, Fe...) will be pursued for diverse sulfate reducing bacteria in pure culture and in coculture with methanogens.

Particular attention will be given to the possible excretion of a nickel chelating agent by bacteria grown in low-nickel medium. The effect of pyrophosphate on the overall process of cellulose degradation to methane will be completed. (3) Enzymology - the function of metals (nickel...) in the hydrogenases of the sulfate reducing bacteria and methanogenic bacteria will continue as hydrogen metabolism appears to play a central role in the metabolism of the organisms. 78 references, 10 figures, 7 tables.

46668 **Combined autoradiography and immunofluorescence for estimation of single cell activity by ammonium-oxidizing bacteria.** Ward, B.B. (Univ. of Washington, Seattle). *Limnology and Oceanography;* 29: No. 2, 402-410(Mar 1984). Contract AT06-76EV75026.

Immunofluorescence and $^{14}CO_2$ autoradiography were used for simultaneously enumerating and assaying the autotrophic activity of ammonium-oxidizing bacteria in seawater. Relative activity ($^{14}CO_2$ assimilation as measured by autoradiography) and abundance were measured in simulated in situ incubations at seven stations in the primary NO_3^- maximum region of the Northeast Pacific Ocean. More than 10^4 cells liter^{-1} were present; relative activity often showed a peak near the surface and an increase in the NO_3^- max region below the photic zone. The method permits assessment of individual cell activity; most cells at all depths were active in CO_2 assimilation, usually at low and quite variable levels. There were no differences in relative activity between samples incubated under simulated in situ conditions and in the dark. Relative activity was positively correlated with the abundance of ammonium-oxidizing bacteria, temperature, total dark CO_2 assimilation (as measured by liquid scintillation counting of replicate samples), and pheopigment concentration, and negatively correlated with oxygen concentration.

46669 **Molecular cloning and preliminary characterization of the RAD6 gene of the yeast, Saccharomyces cerevisiae.** Prakash, L.; Polakowska, R.; Reynolds, P.; Weber, S. (Univ. of Rochester, NY). pp 559-568 of Cellular responses to DNA damage. New York, NY; Alan R. Liss, Inc. (1983).

The RAD6 gene of the yeast, Saccharomyces cerevisiae, plays an important role in DNA repair and mutagenesis. Mutants of the rad6 locus are sensitive to the lethal effects of UV, ionizing radiation methyl methanesulfonate (MMS) and other DNA damaging agents. They are also defective in postreplication repair following UV irradiation and are refractory to UV mutagenesis. We have isolated the RAD6 gene on a recombinant plasmid by complementation for UV resistance of a rad6-1 mutant. The recombinant plasmid restores resistance to UV, gamma rays and MMS to both rad6-1 and rad6-3 mutants. BamHI restriction of the nine rad6 complementing plasmids obtained revealed three different classes. The DNA segment with RAD6 function, determined by the ability to restore radiation resistance to rad6-1 mutants, was transferred to an integrating plasmid, YIp5, and shown by genetic and physical analyses to have integrated at the RAD6 locus. We have localized the RAD6 gene to a 1.5 kb EcoRI-BgIII DNA fragment. Hybridization of total yeast RNA to single strand probes generated by cloning DNA fragments in the phage M13mp8 and M13mp9 indicates that the RAD6 gene encodes two transcripts of 980 nucleotides and 860 nucleotides, respectively. The smaller transcript could determine a protein of about 26,000 daltons.

5509 Pathology

REFER ALSO TO CITATION(S) 55090046650, 46732

46670 **(DOE/EV/03264—T1) Inborn anemias in mice. Progress report.** Bernstein, S.E. (Jackson Lab., Bar Harbor, ME (USA)). 1 Sep 1984. Contract AC02-76EV03264. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017341.

Progress is reported in the following areas: (1) transferrin deficiency and iron loading disease; and (2) bone marrow replacement in the treatment of hemolytic disease in mice. (ACR)

46671 **Preparation and use of phagocytic cells labelled with Tc-99m.** Wilson, R.W.; Buckingham, M.; Friedman, A.M.; Stuart, F. pp 123-124 of Technetium in chemistry and nuclear medicine. Deutsch, E.; Nicolini, M.; Wagner, H.N. Jr. (eds.). Verona, Italy; Cortina International (1983).

Methods of separating live macrophages and labelling them with Tc-99m sulfur colloid are investigated. Their biodistribution in vivo after labelling to observe target ratios are discussed. A series of BAL-C mice which had abscesses in the abdominal wall or in the shoulder area were used for these experiments. The idea of using homogenic phagocytic cells to carry radioactive tracer to abscesses and other areas of intense immune reactivity has long been prevalent. Results indicate the Tc-99m labelled macrophages concentrated in the abscessed areas to the order of 6% of the injected base and had a high concentration ratio when compared to blood or normal tissue ratios. This appears to be a promising technique for diagnosing and locating abscessed areas.

5510 Physiological Systems

REFER ALSO TO CITATION(S) 55100046731, 46735

46672 (ARL/TR—060, pp 33-37) **Model for the variability of lung deposit in man for critical group studies.** Wise, K.N. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

The variability of the deposition of aerosols in the lung has been estimated from experimental data. Expressions used to calculate fractions deposited in the nasopharyngeal, tracheobronchial and pulmonary regions are given.

46673 **(DOE/EV/02270—8) Sensitivity analysis of heat flow through irradiated fur of calves.** Gebremedhin, K.G.; Porter, W.P. (Cornell Univ., Ithaca, NY (USA). Dept. of Agricultural Engineering; Wisconsin Univ., Madison (USA). Dept. of Zoology). 1983. Contract AC02-76EV02270. 17p. (CONF-8308191—1). NTIS, PC A02; 3; GPO Dep. File Number DE84015885.

From American Society of Agricultural Engineers North Atlantic Region conference; Newark, DE, USA (7 Aug 1983).

Paper copy only, copy does not permit microfiche production.

Fractional factorial formations are used in conjunction with a fur heat transfer model in screening variables in which only a subset of the variables is expected to be important on heat transfer through irradiated fur, but which subset is unknown. Nine of the eleven variables tested have statistically significant effects on heat transfer through irradiated fur. The sensitivity of the variables is illustrated. 15 references, 4 figures, 3 tables.

46674 **Role of brain maturation in the evolution of the primates.** Sacher, G.A. (Argonne National Lab., IL). pp 97-112 of Primate brain evolution: methods and concepts. Armstrong, E.; Falk, D. (eds.). New York, NY; Plenum Press (1982). (CONF-8007149—). Contract W-31-109-ENG-38.

From International Primatological Society meeting; Turin, Italy (4 Jul 1980).

All extant primate species conform to a 12% ratio of brain weight to body weight at birth and throughout a considerable part of fetal life, in contrast to a 6% trajectory for the nonprimate taxa. This growth pattern probably evolved at the beginning of the strepsirhine radiation in mid- to late Paleocene, initially as a means to reduce maternal reproductive investment, in adaptation to a requirement for precocial birth in a strictly arboreal niche, coupled with a relatively restricted insect food resource. When a wider range of plant food resources became available, and body size increased, the Haplorhini, including Tarsius, retained the 12% trajectory while returning to a high level of maternal investment. This was an essential preadaptation for their subsequent rapid evolution toward large brain size, which would not have been possible within the restrictions imposed by the 6% brain growth trajectory. 7 figures, 2 tables.

46675 Immunoreactive somatostatin and β-endorphin content in the brain of mature rats after neonatal exposure to propylthiouacil. Kato, N.; Sundmark, V.C.; Van Middlesworth, L.; Havlicek, V.; Friesen, H.G. (Univ. of Manitoba, Winnipeg). *Endocrinology;* 110: No. 6, 1851-1855(1982). Contract AS05-76EV01643.

The contents of immunoreactive somatostatin (IR-SRIF) and β-endorphin (IR-β-EP) in 12 brain regions were examined in rats exposed neonatally to propylthiouracil (PTU) through the mother's milk. Since the dose of PTU used in this study is lower than the usual dose employed to induce hypothyroidism, a milder form of neonatal hypothyroidism resulted. This conclusion is supported by the only mild subnormal growth of rats to adulthood and serum T_4 and T_3 concentrations in the normal range. Adult rats treated with PTU neonatally had significantly higher IR-SRIF contents in several brain regions compared to controls, whereas IR-β-EP levels were not significantly different in most regions. The results indicate that even mild hypothyroidism during early postnatal development causes permanent impairment of brain function, which manifests itself in part by an altered brain content of IR-SRIF.

5520 Public Health

REFER ALSO TO CITATION(S) 55200046712

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 55300046612, 46638, 46673, 46740

46676 (LA-UR—84-2571) Assessing various proposals for novel N-fertilizer supplies and for improving plant internal nutrient-use efficiency. Gutschick, V.P. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 7p. (CONF-8409127—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016820.

From 6. international colloquium on the optimization of plant nutrition; Montpellier, France (2 Sep 1984).

The nitrogen nutrition of crops is very energy intensive, either industrially in fertilizer manufacture or biologically. Numerous strategies can be conceived to fix more N_2, to improve the fraction of applied N that is taken up by the plant, or to improve the fraction of usable N in the plant. The author reviews the thermodynamic, kinetic, physiological, and economic/social constraints on 14 strategies and estimates the prospects for each to contribute to crop nutrition worldwide. Lastly, the author outlines three research programs at Los Alamos that may contribute to several of the strategies. 11 references.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 56011046713

46677 (AECL—7155) Model for the accumulation of cases of pulmonary malignancy in time when dose is accumulated in time. Stewart, C.G. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). May 1983. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702939.

These notes are directed primarily at the formulation of the accumulation of resulting cases of pulmonary malignancy with time when a dose of ionizing radiation (e.g., from airborne short-lived daughters of Rn-222) is protracted in time and when the accumulation of tumours from receipt of the dose occurs after an induction-latent period. The model developed is quite general in that it will allow for the incorporation of the receipt of dose as functions of time, dose-response functions, and functions of time for the accumulation of tumours following and resulting from the receipt of a dose of ionizing radiation.

46678 (AECL—7919) Dose conversion factors for intakes of selected radionuclides by infants and adults. Johnson, J.R.; Dunford, D.W. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jan 1983. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702942.

Since an earlier report on this subject was written in 1979, the International Commission on Radiological Protection (ICRP) has completed its review of its recommended models for internal dosimetry and has published extensive data used in their calculations of annual limits on intake (ALI) for workers. In addition, age dependent models to calculate doses for several elements have been improved, new dosimetry factors have become available in computer readable form, several papers describing the derivation and use of dose conversion factors have been published and errors and omissions in the tables included with the 1979 report have been identified. It was therefore decided to rewrite this report, taking into account the ICRP recommended models and model parameters, the new dosimetry factors, and the new age dependent models. As in the previous report, the committed effective dose equivalent and the committed dose equivalent to the organ receiving the highest dose per unit intake by Reference Infant (the one year old) and Reference Man are given. The revised format of the tables containing this information should make this report considerably easier to use than was the original.

46679 (AECL—7979) Determination of radium-226 in urine. Kramer, G.H.; Beaulieu, P.C. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Mar 1983. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702943.

The method for determining radium-226 in urine that is currently being used by the Bioassay Laboratory has been tested and documented. Radium-226 is coprecipitated from urine by alkaline calcium phosphate. This precipitate is redissolved in hydrochloric acid and the radium purified by cation exchange. Radium is collected by a barium sulphate coprecipitation and then estimated by alpha counting. The method has been tested using radium-226 and cross-contamination studies were performed using Am-241, Pu-239, Np-237, Th-Nat and U-233. With the exception of Am-241, cross-contaminations were found to be negligible. The method gives an overall chemical recovery of 80 +- 5α and the detection limit is estimated to be 0.39 mBq - counting time, 72 h; background, 0.05 counts per minute (cpm).

46680 (ANL—84-30) Division of Biological and Medical Research annual research summary, 1983. Barr, S.H. (ed.). (Argonne National Lab., IL (USA)). Aug 1984. Contract W-31-109-ENG-38. 151p. NTIS, PC A08/MF A01; GPO Dep. File Number DE84017433.

This research summary contains brief descriptions of research in the following areas: (1) mechanisms of hepatocarcinogenesis; (2) role of metals in cocarcinogenesis and the use of liposomes for metal mobilization; (3) control of mutagenesis and cell differentiation in cultured cells by tumor promoters; (4) radiation effects in mammalian cells; (5) radiation carcinogenesis and radioprotectors; (6) life shortening, tumor induction, and tissue dose for fission-neutron and gamma-ray irradiations; (7) mammalian genetics and biostatistics; (8) radiation toxicity studies; (9) hematopoiesis in chronic toxicity; (10) molecular biology studies; (11) chemical toxicology; (12) carcinogen identification and metabolism; (13) metal metabolism and toxicity; and (14) neurobehavioral chronobiology. (ACR)

46681 (ARL/TR—060, pp 81-82) Reduction of pertechnetate (99mTc) by transition metal borides. Pojer, P.M.; Spokas, R.J. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

Iron, cobalt, nickel and copper borides were labelled with technetium-99m. The iron boride accumulated in the liver and lung but nickel and cobalt borides seemed to decompose in vivo and the activity distributed throughout the body.

46682 (ARL/TR—060, pp 62-64) **Method of determining skin dose from the radiographic factors used.** Morris, N.D. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

An order of magnitude estimate of the skin dose per exposure to a patient undergoing a radiographic examination may be calculated using the formula $D = 70 \times (kV)^2 \times mAs/(SSD)^2$ where D is the skin dose per exposure in μGy and SSD is the source-skin distance in cm. This will give a reasonable answer for 50% of X-ray units and will be accurate to within +- 35%.

46683 (ARL/TR—060, pp 85-89) **Procedure used to estimate the lung burden of uranium.** Kotter, L.H. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

Two problems arise in determining the lung or body burden of an individual. The first is to determine the type of phantom which will satisfactorily simulate the subject and the second is to estimate the response of the measurement system to the subject if he were not contaminated in order to generate a base spectrum to which the actual subject spectrum is compared.

46684 **(BNL—51761) Medical status of Marshallese accidentally exposed to 1954 Bravo fallout radiation: January 1980-December 1982.** Adams, W.H.; Harper, J.A.; Rittmaster, R.S.; Heotis, P.M.; Scott, W.A. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017140.

This report updates, for 1980 through 1982, the results of continuing medical surveillance of a Marshallese population accidentally exposed to radioactive fallout in March 1954. The originally exposed Marshallese population comprised 64 persons on Rongelap Atoll who each received, on the average, an estimated 190 rads of absorbed external gamma radiation, 18 on Ailingnae Atoll who received 110 rads, and 159 on Utirik who received 11 rads. There were, in addition, 3 persons in utero on Rongelap, 1 person in utero on Ailingnae, and 8 persons in utero on Utirik who are considered exposed. The recipients of primary medical care include exposed and comparison populations as well as a rather large number of additional beneficiaries who are seen on a humanitarian basis of practical need and resource availability. In recent years, about 1400 people have been seen annually. This report, however, deals with four clearly defined groups: the remaining individuals who were exposed to radioactive fallout on Rongelap, Ailingnae, and Utirik in 1954 (including those in utero), and a comparison population of individuals from Rongelap who were unexposed. The number of persons now in each exposure category are 51, 12, 116, and 137, respectively. 100 references, 4 figures, 5 tables. (ACR)

46685 **(DOE/EV/02040—16) Factors affecting mutational specificity in mammalian cells. Progress report.** (Chicago Univ., IL (USA)). 20 Aug 1984. Contract AC02-76EV02040. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017232.

Portions are illegible in microfiche products.

Progress is reported in two areas: (1) a study of the properties of lymphoblastoid lines deficient in their ability to remove O^6-methylguanine; and (2) a methodology for the determination of the site of termination of DNA synthesis on templates reacted with carcinogen in vitro and used for in vitro DNA synthesis with different polymerases. (ACR)

46686 **(JINR—19-83-743) Role of DNA repair in the realization of oxygen effect in bacteria ESCHERICHIA COLI irradiated with various types of radiation (theoretical analysis). The LET dependence of oxygen effect. The induction of basic types of DNA damage and their modification by oxygen.** Kozubek, S.; Krasavin, E.A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1983. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702938.

The regularities of the induction of basic types of DNA injuries influencing OER by the radiations of different LETs are considered. The DNA injuries arising from two, three and more acts of energy depositions are shown to increase with increasing LET. On the basis of proposed model the amount of irreparable by repair 11 single-strand breaks (Nsub(SSB1)sup(ir)) DNA in the dependence on LET is estimated. The dependence Nsub(SSB1)sup(ir) (LET) forms a slight maximum typical of multihit processes. The maximum arises in the region of LET 200-300 keV/μm. The amounts of direct double-strand breaks (Nsub(dDSB)) DNA in both the presence and absence of oxygen in the dependence on LET have been estimated, too. The calculations show that in the region beyond the maximum of Nsub(dDSB) (LET) dependence constant ratio between NsUb(dDSB) in oxic and anoxic conditions is preserved. In the region of the maximum the ratio decreases. On the basis of our analysis a critical look at both the "interacting radicals" and "oxygen in track" hypotheses is given.

46687 (LMF—107, pp 177-182) **Toxicity studies of inhaled β-emitting radionuclides: status report.** Hahn, F.F.; McClellan, R.O.; Boecker, B.B.; Hobbs, C.H.; Jones, R.K.; Lundgren, D.L.; Mauderly, J.L.; Muggenburg, B.A.; Pickrell, J.A.; Redman, H.C. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

The influence of total dose and dose rate on the effects of inhaled β-emitting radionuclides is being studied in laboratory animals. The radionuclides are inhaled either in a relatively soluble form ($^{90}SrCl_2$, $^{144}CeCl_3$, $^{91}YCl_3$, or $^{137}CsCl$), or in a relatively insoluble form in fused aluminosilicate particles. Which organs are affected depends on the solubility and chemical characteristics of the radionuclides. Studies with young adult dogs are complemented by comparable studies in other species (mice, rats, and Syrian hamsters), with animals of different ages and animals repeatedly exposed to ^{144}Ce.

46688 (LMF—107, pp 183-189) **Toxicity of inhaled $^{90}SrCl_2$ in Beagle dogs. XVII.** McClellan, R.O.; Griffith, W.C.; Muggenburg, B.A.; Hahn, F.F.; Boecker, B.B.; Jones, R.K. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

Beagle dogs were exposed to aerosols containing $^{90}SrCl_2$ to obtain initial body burdens ranging from 2.5 to 250 μCi ^{90}Sr/kg body weight. These dogs were maintained for lifetime observation or assigned to a sacrifice schedule. Dogs have died from a variety of causes related to radiation exposure, including bone marrow aplasia and bone-related neoplasms. During the past few years, most deaths have been due to conditions associated with aging, such as renal insufficiency and a variety of tumors in organs receiving low doses of radiation relative to the skeleton, which is the primary target of radiation exposure for internally deposited ^{90}Sr. All dogs in the study are now dead, and analyses of the dose-response relationships are in progress. Preliminary analyses yield a risk estimate for ^{90}Sr in man of 2.4×10^{-6} to 12×10^{-6} skeletal cancers per person-rad to the skeleton.

46689 (LMF—107, pp 190-193) **Toxicity of inhaled $^{91}YCl_3$ in Beagle dogs. XVII.** Hahn, F.F.; Muggenburg, B.A.; Boecker, B.B.; Jones, R.K.; McClellan, R.O.; Pickrell, J.A. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

The metabolism, dosimetry, and biological effects of inhaled $^{91}YCl_3$ in Beagle dogs are being studied. Forty-two dogs with initial ^{91}Y body burdens from 14 to 1300 μCi/kg body weight and 12 control dogs were observed during their life spans. Four additional dogs with a mean initial body burden of 180 μCi ^{91}Y/kg body weight were placed in a sacrifice study. All 46 of the exposed dogs and all 12 of the control dogs have died. Dogs with the highest initial body burdens died with bone marrow damage and pancytopenia. Three dogs died with nasal cavity carcinomas, three died with pulmonary carcinomas, and one died with hepatic hemangiosarcoma. These cancers all appeared to be related to radiation

injury. Control dogs died of miscellaneous neoplastic and chronic diseases.

46690 (LMF—107, pp 194-197) **Toxicity of inhaled $^{144}CeCl_3$ in Beagle dogs. XVI.** Boecker, B.B.; Hahn, F.F.; Muggenburg, B.A.; McClellan, R.O.; Pickrell, J.A. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

The metabolism, dosimetry, and biological effects of inhaled $^{144}CeCl_3$ in Beagle dogs are being studied to assess the consequences of inhaling ^{144}Ce. Studies have shown that ^{144}Ce deposited in lung as $^{144}CeCl_3$ is translocated at a moderately rapid rate to liver and skeleton and that significant radiation doses are accumulated by all three organs. The dogs exposed to ^{144}Ce had long-term retained burdens that ranged from 2.6 to 360 μCi ^{144}Ce/kg body weight. All 55 of the dogs exposed to $^{144}CeCl_3$ and 16 of 17 control dogs have died. There is one control dog surviving at 5828 days (— 16 years) after entry into this study.

46691 (LMF—107, pp 198-202) **Toxicity of injected $^{137}CsCl$ in Beagle dogs. XVI.** Muggenburg, B.A.; Hahn, F.F.; Boecker, B.B.; Jones, R.K.; McClellan, R.O.; Pickrell, J.A.; Redman, H.C. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

Studies of the metabolism, dosimetry, and effects of intravenously administered $^{137}CsCl$ in the Beagle dog are being conducted to aid in assessing the biologic consequences of exposure to ^{137}Cs that might occur in the event of certain nuclear accidents. Effects of the chronic, relatively uniform whole-body exposures produced by ^{137}Cs are being compared with other diverse radiation dose patterns resulting from inhalation of radioactive aerosols. Fifty-four of the dogs that were injected with $^{137}CsCl$ have died, as have eight control dogs; four exposed and two control dogs died during the past year. Serial observations are continuing on the surviving four control dogs.

46692 (LMF—107, pp 203-207) **Toxicity of ^{90}Y in a relatively insoluble form inhaled by Beagle dogs. XV.** Hahn, F.F.; Hobbs, C.H.; McClellan, R.O.; Mauderly, J.L.; Pickrell, J.A. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

The metabolism, dosimetry, and biological effects of inhaled ^{90}Y in fused aluminosilicate particles are being studied in Beagle dogs. Eighty-nine dogs with initial lung burdens ranging from 80 to 5200 μCi ^{90}Y/kg body weight and 12 control dogs are being maintained for life-span observations. The lung burdens achieved, short physical half-life, and relative insolubility of the ^{90}Y in this vector resulted in a relatively high, rapidly decreasing radiation dose rate to the lung. To date, 76 exposed dogs have died; 38 from radition pneumonitis, 7 with pulmonary neoplasms, and 31 from other causes. Seven control dogs have died. Thirteen exposed and five control dogs still survive at 4600 to 5118 days after entry onto the study.

46693 (LMF—107, pp 208-212) **Toxicity of ^{91}Y inhaled in a relatively insoluble form by Beagle dogs. XIV.** Hahn, F.F.; Muggenburg, B.A.; Hobbs, C.H.; McClellan, R.O.; Pickrell, J.A. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

Beagle dogs were exposed by inhalation to aerosols of ^{91}Y in fused aluminosilicate particles, resulting in initial lung burdens ranging from 11 to 300 μCi ^{91}Y/kg body weight. These 96 dogs, plus 12 controls, were maintained for life span observation or assigned to a sacrifice schedule to study radiation dose patterns. Dogs with higher lung burdens died at early times with radiation pneumonitis. At later times, tumors were seen in lung, nasal cavity, heart, and tracheobronchial lymph nodes; these organs received the highest radiation doses. Observations are continuing on the 16 exposed and 6 control dogs that remain alive 12 to 13.5 years after exposure.

46694 (LMF—107, pp 213-219) **Toxicity of ^{144}Ce inhaled in a relatively insoluble form by Beagle dogs. XVI.** Boecker, B.B.; Hahn, F.F.; Muggenburg, B.A.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

The metabolism, dosimetry, and effects of ^{144}Ce inhaled in fused aluminosilicate particles are being investigated using Beagle dogs to assess the long-term biological consequences of the release of relatively insoluble aerosol forms of ^{144}Ce that could occur in nuclear accidents. One hundred eleven dogs were exposed to aerosols of ^{144}Ce in fused aluminosilicate particles to yield initial lung burdens of 0.0024 to 210 μCi ^{144}Ce/kg body weight, and 15 control dogs were exposed to nonradioactive fused aluminosilicate particles. To date, 90 ^{144}Ce-exposed and 10 control dogs have died or were euthanized at 143 to 5454 days after inhalation of ^{144}Ce. Observations are continuing on the 21 ^{144}Ce-exposed and 5 control dogs alive now, at least 4433 days (— 12 years) after exposure.

46695 (LMF—107, pp 220-223) **Toxicity of ^{144}Ce inhaled in a relatively insoluble form by immature Beagle dogs. XII.** Boecker, B.B.; Muggenburg, B.A.; Hahn, F.F.; Mauderly, J.L.; McClellan, R.O. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

Immature Beagle dogs (3 months old) were exposed once by inhalation to an aerosol of ^{144}Ce incorporated in fused aluminosilicate particles. The influence of this age on the dose-response relationships is being compared to that of 13-mo-old and 8 to 10.5-yr-old dogs. This study involves 49 dogs that received graded initial lung burdens from 0.004 to 140 μCi ^{144}Ce/kg body weight and five control dogs. To date, 19 of the ^{144}Ce-exposed dogs and one of the controls have died. Dogs with the highest initial lung burdens of ^{144}Ce died during the first 4 months with radiation pneumonitis, pulmonary fibrosis, and congestive heart failure. Pulmonary hemangiosarcoma was the primary finding in dogs that died at 1.5 to 2 years after exposure. Deaths beyond that time have been due primarily to extrapulmonary hemangiosarcomas. Observations are continued on the surviving 30 ^{144}Ce-exposed and four control dogs at 7.0 to 11.2 years after exposure.

46696 (LMF—107, pp 224-225) **Toxicity of ^{144}Ce inhaled in a relatively insoluble form by aged Beagle dogs. XII.** Boecker, B.B.; Hahn, F.F.; Muggenburg, B.A.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

The toxicity of relatively insoluble ^{144}Ce inhaled by 8- to 10.5-year-old Beagle dogs is being investigated to determine possible age-related differences in long-term biological responses. Forty-two dogs were exposed to aerosols of ^{144}Ce in fused aluminosilicate particles to yield initial lung burdens of 2.2 to 75 μCi ^{144}Ce/kg body weight, and 12 control dogs were exposed to non-radioactive fused aluminosilicate particles. All ^{144}Ce-exposed and control dogs have died or were euthanized between 197 and 2726 days after the inhalation exposure. Prominent findings in the ^{144}Ce-exposed dogs were radiation pneumonitis in 19 of the 23 dogs that died during the first 943 days after exposure, and neoplastic disease in 13 of the 20 dogs that died beyond 904 days after exposure. Pulmonary tumors were found in five of these dogs. In contrast to the study with young adult dogs, in which pulmonary hemangiosarcomas were one of the prominent findings, all of these tumors were carcinomas.

46697 (LMF—107, pp 228-231) **Toxicity of ^{90}Sr inhaled in a relatively insoluble form by Beagle dogs. XIV.** Snipes, M.B.; Hahn, F.F.; Muggenburg, B.A.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

Beagle dogs were exposed by inhalation to ^{90}Sr in a relatively insoluble form to study long-term health effects. Lung burdens

ranged from 0.12 to 96 μCi of ^{90}Sr/kg body weight. High levels of exposure resulted in radiation pneumonitis and pulmonary fibrosis; lower level exposures caused long-term effects, including cancer of the lung, heart, and tracheobronchial lymph modes. Most of these tumors were hemangiosarcomas. Two control dogs and two ^{90}Sr-exposed dogs died or were euthanized during the past year. One exposed dog died with hemangiosarcoma of the spleen; the other exposed dog died with pulmonary thrombosis. One control dog died of pulmonary carcinoma, and the other control dog died of a carcinoma of the bladder. The remaining 19 exposed and 11 control dogs are being maintained for lifetime observation.

46698 (LMF—107, pp 232-236) **Biological effects of repeated inhalation exposure of Beagle dogs to relatively insoluble aerosols of ^{144}Ce. IX.** Boecker, B.B.; Hahn, F.F.; Muggenburg, B.A.; McClellan, R.O.; Mauderly, J.L.; Pickrell, J.A. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

Beagle dogs were exposed repeatedly to a relatively insoluble form of ^{144}Ce to study the deposition, retention, and long-term biological effects for comparison with data from dogs that were exposed only once to a similar aerosol. Four groups of nine dogs each were exposed once every 8 weeks for 2 years (13 exposures). Exposure goals were: to increase the lung burden by 2.5 μCi ^{144}Ce/kg body weight with each exposure; to re-establish lung burdens of 9 or 4.5 μCi ^{144}Ce/kg body weight; and to expose controls to fused aluminosilicate particles containing nonradioactive Ce. To date, 25 exposed dogs and 3 control dogs have died or were euthanized. The most prevalent findings have been pulmonary carcinomas (nine dogs), and hemangiosarcomas in the tracheobronchial lymph nodes (five dogs). Observations are continuing on the two surviving ^{144}Ce-exposed and six control dogs that are now at approximately 3590 days (9.8 years) after the first exposure.

46699 (LMF—107, pp 237-242) **Toxicity of inhaled α-emitting radionuclides: status report.** Muggenburg, B.A.; Mewhinney, J.A.; Guilmette, R.A.; Hahn, F.F.; Boecker, B.B.; Mauderly, J.L.; Lundgren, D.L.; Hobbs, C.H.; McClellan, R.O. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

A series of interrelated dose-response studies in which Beagle dogs and rodents are being exposed to aerosols of transuranic α-emitting radionuclides is described. Monodisperse aerosols of oxides of ^{239}Pu, ^{238}Pu, ^{241}Am, and ^{244}Cm are used in studies to measure the relative importance of average organ dose, local dose around particles, specific activity, particle size, and number of inhaled particles to the development of biological effects. The elemental characteristics, chemical form, species of animal, and age of animal at the time of inhalation exposure are also being studied because they may influence the toxicity of these radionuclides.

46700 (LMF—107, pp 243-251) **Toxicity of inhaled $^{238}PuO_2$ in Beagle dogs. A. Monodisperse 1.5 μm AMAD particles. B. Monodisperse 3.0 μm AMAD particles. X.** Mewhinney, J.A.; Hahn, F.F.; Muggenburg, B.A.; White, J.E.; Diel, J.H.; Mauderly, J.L.; Boecker, B.B.; McClellan, R.O. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

Beagle dogs have received an inhalation exposure to one of two sizes of monodisperse aerosols of $^{238}PuO_2$ to achieve graded levels of initial lung burden. All dogs are being studied over their life span. Ninety dogs have died with initial lung burdens ranging from 0.01 to 1.5 μCi ^{238}Pu/kg body weight; 8 died of radiation pneumonitis and pulmonary fibrosis, 4 died of lung tumors, 64 died of bone tumors, 1 died of a liver tumor, and 12 died of miscellaneous causes. Four control dogs have died. Fifty-four exposed and 20 control dogs survive at 2388-3414 days after exposure.

46701 (LMF—107, pp 252-259) **Toxicity of inhaled $^{239}PuO_2$ in Beagle dogs. A. Monodisperse 0.75 μm AMAD particles. B. Monodisperse 1.5 $^{+}$m AMAD particles. C. Monodisperse 3.0 μm AMAD particles. VI.** Muggenburg, B.A.; Guilmette, R.A.; Hahn, F.F.; Boecker, B.B.; McClellan, R.O.; Mauderly, J.L.; Pickrell, J.A. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

Studies on the metabolism, dosimetry, and biological effects of inhaled particles of $^{239}PuO_2$ in Beagle dogs are in progress. To obtain information on the relative importance of homogeneity versus nonhomogeneity of radiation doses to the lung, dogs have been exposed to monodisperse aerosols of $^{239}PuO_2$ of 0.75, 1.5, or 3.0 μm activity median aerodynamic diameter (AMAD). The exposures have resulted in graded initial lung burdens ranging from 0.0002 to 2.6 μCi ^{239}Pu/kg body weight. Other dogs exposed to the aerosol diluent served as controls. The number of dogs that have died to date are 16 in the study with 0.75 μm AMAD particles, 55 in the study with 1.5 μm AMAD particles, and 40 in the study with 3.0 μm AMAD particles. Major findings at death have been radiation pneumonitis, pulmonary fibrosis, and carcinomas of the lung. The remaining dogs have survived up to 2400 days after inhalation exposure and are being observed for the rest of their lives.

46702 (LMF—107, pp 260-263) **Toxicity of inhaled $^{239}PuO_2$ in immature Beagle dogs. V.** Guilmette, R.A.; Muggenburg, B.A.; Hahn, F.F.; Mauderly, J.L.; Boecker, B.B.; McClellan, R.O. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

Immature Beagle dogs have been exposed by inhalation to a monodisperse aerosol of $^{239}PuO_2$ (1.5 μm AMAD) to compare the biological effects with those observed in young adult and aged dogs exposed to a similar aerosol. The study includes 96 dogs exposed to $^{239}PuO_2$ and 12 controls. The lung burdens in the plutonium-exposed dogs ranged from 0.00030 to 0.80 μCi/kg body weight. During the past year, two dogs died from causes apparently unrelated to radiation effects. With a median time on study of 700 days, there have not yet been any deaths related to α irradiation of the lung, even though 11 dogs have cumulative lung doses greater than 1000 rad.

46703 (LMF—107, pp 264-268) **Toxicity of inhaled $^{239}PuO_2$ in aged Beagle dogs. V.** Muggenburg, B.A.; Hahn, F.F.; Guilmette, R.A.; Boecker, B.B.; McClellan, R.O. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

Studies to determine the effects of age at exposure on the metabolism, dosimetry, and biological effects of inhaled particles of $^{239}PuO_2$ are in progress in aged Beagle dogs (8.0 to 10.5 years of age at exposure). Forty-eight dogs have inhaled particles of $^{239}PuO_2$ having an activity median aerodynamic diameter of 1.5 μm to achieve initial lung burdens ranging from 0.02 to 0.66 μCi ^{239}Pu/kg body weight. Twelve dogs exposed to the aerosol diluent serve as controls. Thirty-five exposed dogs have died, including 10 in the past year. The principal causes of death were radiation pneumonitis and pulmonary fibrosis. Three control dogs have died. The 13 surviving exposed dogs and 9 controls are continuing to be observed.

46704 (LMF—107, pp 269-273) **Repeated inhalation exposure of Beagle dogs to aerosols of $^{239}PuO_2$. VII.** Diel, J.H.; Hahn, F.F.; Guilmette, R.A.; Lundgren, D.L. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

Dogs were exposed once or repeatedly by inhalation to aerosols of $^{239}PuO_2$ to study the relative doses and effects of these two types of exposures. Dogs still alive in this study have been exposed twelve times and maintained at least 5.7 years after their first exposure. To date, 14 dogs have died from radiation pneumonitis and pulmonary fibrosis, and of these, three had pulmonary carcinomas at death. One dog died from a pulmonary carcinoma.

46705 (LMF—107, pp 274-277) **Repeated inhalation exposure of rats to aerosols of $^{239}PuO_2$. II.** Lundgren, D.L.; Hahn, F.F.; Diel, J.H. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

The effects of protracted α irradiation of rat lungs are being studied. Rats have been exposed once or repeatedly to aerosols of ^{239}PuO to achieve or to re-establish lung burdens of ^{239}Pu that will result in projected lifetime α radiation doses to the lungs of 20, 60, 200, or 600 rad. All exposures have been completed. More than 50% of the rats in most experimental groups remain alive. The lung retention of ^{239}Pu in 84- and 440-day-old rats and among male and female rats exposed once to $^{239}PuO_2$ was similar.

46706 (LMF—107, pp 283-287) **Retention, distribution, and cytogenetic effects of inhaled $^{239}Pu(NO_3)_4$ in the cynomolgus monkey.** Brooks, A.L.; Redman, H.C.; Hahn, F.F.; Mewhinney, J.A.; Smith, J.M.; McClellan, R.O. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

Inhalation of plutonium nitrate by cynomolgus monkeys resulted in activity being deposited in the lungs, followed by translocation to liver and bone. Activity in the testes was 0.0001 of the initial lung burden and was concentrated in the interstitial tissue. No increase in chromosome aberration frequency was observed in blood lymphocytes as a function of time after plutonium inhalation. When all chromosome data were combined, there was a small exposure-level-dependent increase in the frequency of chromosome aberrations in blood lymphocytes after inhalation of large quantities of plutonium. In cynomolgus monkeys, the frequency of chromosome aberrations in blood lymphocytes is not a good indicator of radiation dose or damage from inhaled plutonium.

46707 (LMF—107, pp 288-291) **Induction of chromosome aberrations in the liver of the Chinese hamster by injected thorotrast.** Brooks, A.L.; Guilmette, R.A. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

After Chinese hamsters were injected with colloidal thorium dioxide (Thorotrast) and serially sacrificed, the frequency of chromosome aberrations in their liver cells was determined. The chromosome aberration frequency increased linearly with time. The radiation dose to the liver was estimated at each time interval where aberrations were recorded, and the slope of the dose response curve was compared to that observed for animals injected with either α- (^{239}Pu) or β (^{144}Ce-^{144}Pr) emitting radionuclides. The slope for the Thorotrast-induced aberrations (2.1×10^{-3} aberrations/cell/rad) was lower than that for ^{239}Pu (4.8×10^{-3}), but greater than that for ^{144}Ce (0.31×10^{-3}). This suggests either that the doses were overestimated in the case of Thorotrast or that the non-uniform α-dose distribution from the Thorotrast resulted in more wasted radiation than with the more uniformly deposited ^{239}Pu. Both of these factors would decrease the slope of the dose response curve for Thorotrast.

46708 (LMF—107, pp 292-297) **Influence of age and $^{239}PuO_2$ exposure on the pulmonary immune response of dogs.** Galvin, J.; Bice, D.E.; Muggenburg, B.A. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

This study evaluated the influence of age and $^{239}PuO_2$ inhalation on the humoral immune response of the lungs of Beagle dogs after local deposition of antigen. Four dogs had received a single brief exposure (5 to 6 years earlier) by pernasal inhalation to one of three monodisperse PuO_2 aerosols of 0.72 μm, 0.75 μm, or 1.4 μm activity median aerodynamic diameter. This resulted in initial lung burdens of 0.52 to 1.10 μCi and lymph node doses of 72-144 krad. Four non-exposed dogs served as age-matched controls. The humoral immune response was measured by the enzyme-linked immunosorbent assay, which showed that even though some dogs had a high IgG antigen-specific antibody response in the serum, the same dogs did not recruit immune effector cells and products into the lung. Age influenced the recruitment of serum immunoglobulins into the lung.

46709 **(NCRP—72) Radiation protection and measurement for low-voltage neutron generators.** (National Council on Radiation Protection and Measurements, Bethesda, MD (USA)). 1 Nov 1983. 86p. NCRP Publications, 7910 Woodmont Ave., Suite 1016, Bethesda, MD 20814. File Number TI84901556.

This report is concerned with neutron generators that operate at voltages below a few hundred kilovolts and produce neutrons chiefly by the T(d,n) reaction. The report provides information on the radiation protection problems in the use of these generators and the means available for dealing with these problems. It is intended to serve as a guide to good practice and bring together in one place, a number of recommendations relevant to the use of low voltage neutron generators that have appeared in other NCRP documents. The report surveys the radiations produced by low voltage neutron generators and their measurement. It then addresses the fundamentals of radiation protection, including shielding and physical safeguards. Guidance is given on radioactive waste resulting from the use of neutron generators and information is provided on non-radiation hazards and licensing. 91 references, 4 figures, 7 tables.

46710 **(NUREG/CR—3870) Radiation dose estimates and hazard evaluations for inhaled airborne radionuclides. Annual progress report, July 1982-June 1983.** Mewhinney, J.A. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst.). Jul 1984. 37p. NTIS, PC A03/MF A01 - GPO* $3.75. File Number TI84901767.

The objective of this project is to conduct confirmatory research on aerosol characteristics and the resulting radiation dose distribution in animals after inhalation and to provide prediction of health consequences in humans from airborne radioactivity that might be released in normal operations or under accident conditions during production of nuclear fuel composed of mixed oxides of uranium and plutonium. Two research reports summarize the progress of current research. The first paper details results from the completed radiation dose distribution studies in which dogs, monkeys and rats were exposed to either $UO_2 + PuO_2$ treated at 750°C, $(U,Pu)O_2$ treated at 1750°C, or PuO_2 treated at 850°C. This paper focuses on analysis of the data from the last animals sacrificed in the study and updates earlier analyses of lung retention, tissue distribution, and excretion. The second paper details preliminary analyses of the lung retention in Fischer-344 rats exposed to either $(U,Pu)O_2$ at one of three levels of projected dose to lung for each aerosol. This paper presents the methods and the application of a rigorous statistical procedure allowing detection of similarities and differences in the lung retention of rats at different dose levels and for different aerosols. This preliminary work is necessary before final analyses of these data can be done when all animals have died. The paper presents complete development of the data to allow calculation of radiation dose to lung and other tissues for animals in these studies and will lead to the analysis of dose-response relationships. 4 references, 9 figures, 9 tables.

46711 **(SSI-A—83-18) Personnel doses on the handling of $^{99}Tc(sup)m$ at hospitals.** Ahlgren, L.; Bjurman, B.; Mattsson, S. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Dec 1983. 40p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE84702944.

The absorbed whole-body dose to the personnel working full time with nuclear medicine investigations in vivo is found to be 1-4 m Gy/a, as measured on the film badge and corresponding to a dose equivalent of 0.7 to 2.8 m Sv. The patient is contributing 1 to 2 m Gy. The absorbed dose to the fingers of the personnel easily exceeds 500 m Sv/a emanating from the syringes and bottles. The injection of patients renders the highest exposures. If rubber gloves were not used the contamination from 1 kBq $^{99}Tc(sub)m$ will be 0.5 Gy/h^{-1} to the skin. Latex rubber gloves will provide sufficient protection when used less than for 30 minutes.

46712 (UCRL—15629) Case-control study of malignant melanoma among Lawrence Livermore National Laboratory employees. Austin, D.F.; Reynolds, P. (California Dept. of Health Services, Berkeley (USA)). 16 Aug 1984. Contract W-7405-ENG-48. 127p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84016225.

Portions are illegible in microfiche products.

In April, 1980, the California Department of Health Services released the results of a study which established that, for the period 1972-1977, the employees of the Lawrence Livermore National Laboratory (LLNL) had experienced a rate of malignant melanoma (MM) that was three to four times higher than that which would be expected under normal circumstances. This report details a follow-up investigation designed to search for the reason or reasons for that previously established excess. We identified thirty-two cases of MM among active employees of the LLNL from 1969 to mid-1980. All cases were included in a case-control study although one case was unavailable for personal contact. The results of this report are based primarily on the 31 cases for whom interviews were completed and 110 out of the 113 controls with completed interviews who were matched to those cases, a total of 141 respondents. 79 references, 2 figures, 44 tables. (ACR)

46713 Inhibition of x-ray- and ultraviolet light-induced transformation in vitro by modifers of poly(ADP-ribose) synthesis. Borek, C.; Ong, A.; Morgan, W.F.; Cleaver, J.E. (Columbia Univ., New York, NY). *Radiation Research;* **99**: No. 2, 219-227(Aug 1984). (CONF-830220—).

From 31. annual meeting of the Radiation Research Society - epidemiology of irradiated human populations; San Antonio, TX, USA (27 Feb 1983).

Neoplastic transformation in vitro of hamster embryo cells and mouse C3H 10T1/2 cells by X rays and ultraviolet light was suppressed by benzamide or 3-aminobenzamide, agents which inhibit poly(ADP-ribose) polymerization. Suppression was observed under conditions in which the inhibitors reduce poly(ADP-ribose) polymerization by about 75% and increase sister chromatid exchange frequencies, but have no influence on repair of X-ray and uv damage and reportedly have no detectable side effects on nucleotide precursor metabolism. These findings suggest that the mechanisms regulating neoplastic transformation differ from those regulating mutagenesis and sister chromatid exchanges and are mediated via alterations in poly(ADP-ribosylation), causing changes in gene control and expression.

46714 Evidence that a second event in x-ray-induced oncogenic transformation in vitro occurs during cellular proliferation. Kennedy, A.R.; Little, J.B. (Harvard School of Public Health, Boston, MA). *Radiation Research;* **99**: No. 2, 228-248(Aug 1984). (CONF-830220—). Contract AC02-77EV04322.

From 31. annual meeting of the Radiation Research Society - epidemiology of irradiated human populations; San Antonio, TX, USA (27 Feb 1983).

Data are reported here on the distributions of transformed-cell clone sizes in irradiated cultures reseeded at various times post-treatment. The results suggest that the second event in transformation occurs radomly during the growth of irradiated cultures of C3H 10T1/2 cells to confluence. When the same number of irradiated C3H 10T1/2 cells were seeded into petri dishes of different sizes, the number of foci which arose per dish was dependent on the final cell numbers at confluence in the various dish sizes, such that the number of foci/cm^2 was constant. When irradiated cells and parental C3H 10T1/2 cells were mixed in different proportions at low density, the number of foci which ultimately arose was a function of the number of progeny of irradiated cells present in the culture at confluence. The results presented here confirm previous studies and give further evidence that the radiation-induced malignant transformation of cells occurs in an indirect, multistage fashion.

46715 Repair processes and radiation quality in neoplastic transformation of mammalian cells. Han, A.; Hill, C.K.; Elkind, M.M. (Argonne National Lab., IL). *Radiation Research;* **99**: No. 2, 249-261(Aug 1984). (CONF-830220—). Contract W-31-109-ENG-38.

From 31. annual meeting of the Radiation Research Society - epidemiology of irradiated human populations; San Antonio, TX, USA (27 Feb 1983).

Appropriate in vitro mammalian cell systems facilitate the study of cellular mechanisms of radiation oncogenesis. C3H 10T1/2 cells derived from mouse embryo have been used to study the effects of protracted irradiation on cell killing and incidence of neoplastic transformation. Protracted exposures of ^{60}Co γ rays or fission-spectrum neutrons (from the JANUS reactor at the Argonne National Laboratory) were given either at low dose rates or as multifractionated regimens using high dose rates. Dose protraction of γ rays by multifractionation at a high dose rate (50 rad/min) results in appreciable reduction in cell killing and also significantly reduces the incidence of neoplastic transformation. Irradiation at a low dose rate has the same qualitative effect. In contrast, protracted exposures of fission-spectrum neutrons, given at a low dose rate (0.086 or 0.43 rad/min), result in significant enhancement of the frequency of transformation in the dose region of up to 80 rad. However, the survival of cells is essentially the same as that for the same single dose of neutrons given at a high dose rate. These observations are consistent with net "error-free" repair of transformational damage following protracted exposure of a low LET radiation and possibly a net "error-prone" repair of transformational damage after protracted irradiations with fission-spectrum neutrons.

46716 Comments on "V79 survival following simultaneous or sequential irradiation by 15-MeV neutrons and ^{60}Co photons" by Higgins et al. [Radiat. Res. 95, 45-56(1983)]. Zaider, M.; Brenner, D.J. (Columbia Univ., New York, NY). *Radiation Research;* **99**: No. 2, 438-441(Aug 1984). Contract AC02-78EV04733.

In a recent paper Higgins et al. reported survival data for V79 Chinese hamster cells exposed simultaneously or sequentially to 15-MeV neutrons and ^{60}Co photons. In each case the results showed the combined modality to be more effective at cell killing than would be expected from the simple multiplication of the effects due to each radiation alone. Thus the effects of the two radiations are synergistic. In addition, simultaneous exposures yielded lower surviving fractions than sequential ones. Both these results are easy to understand, at least qualitatively, if the concepts of sublethal damage and sublethal damage repair are used. The proposition that simultaneous exposure is more effective than sequential ones thus proposition that simultaneous exposure is more effective than sequential ones thus becomes evident. Theoretical expressions have been derived also to quantify these phenomena. Higgins et al. rederive several of the equations previously obtained, however, the interpretation that they give to these equations is not appropriate. It is the purpose of this note to comment on some of these problems and offer a simple analysis and interpretation of the results based on sublethal damage repair.

46717 Computed tomography analysis of the canine brain: effects of hemibrain x irradiation. Fike, J.R.; Cann, C.E.; Davis, R.L.; Borcich, J.K.; Phillips, T.L.; Russell, L.B. (Univ. of California, San Francisco). *Radiation Research;* **99**: No. 2, 294-310(Aug 1984). Contract AC03-76SF01012.

Radiation damage induced by megavoltage X irradiation in normal brain tissue can manifest as one of several pathologic processes depending upon the time of brain examination after irradiation. Serial quantitative computed tomography (QCT) analyses were used to study the development of radiation damage in the normal canine brain. Tissue density, volume of low density areas, magnitude and volume of contrast uptake, and ventricular volume were measured following hemibrain irradiation and were correlated with histopathology. Low density areas correlated with edema, demyelination, axonal swelling, and necrosis and appeared 3-4 months after irradiation. Large regions of contrast enhancement appeared 5-6 months after irradiation. Results from this study demonstrated that the pathologic changes induced in the dog brain after single doses of X rays were similar to the changes observed in nonhuman primates and man after exposure to radiation.

46718 Relationship of bone marrow type and microvasculature of the microdistribution and local dosimetry of plutonium in the adult skeleton. Smith, J.M.; Miller, S.C.; Jee, W.S.S. (Univ. of Utah School of Medicine, Salt Lake City). *Radiation Research;* **99**: No. 2, 324-335(Aug 1984).

Most plutonium-induced bone tumors in beagles arise in trabecular bone sites surrounded by hematopoietic tissue. The microvasculature and the relative incorporation of ^{241}Pu (a low energy β emitter) on trabecular bone surfaces from red and fatty marrow sites were studied in the adult beagle. The vascular volume, as determined by India ink perfusion, was about 16% in the red marrow and about 2% in the fatty marrow. Plutonium concentrations on bone surfaces of red marrow sites are about 0.43 pCi/cm^2/nCi/kg of injected dosage, a factor of eight greater than at fatty marrow sites. The differences in the bone marrow microvasculature between red and fatty marrow help to explain differences in plutonium incorporation and local bone physiology in these skeletal sites. These observations may relate to the nonuniform distribution of plutonium-induced osteosarcomas observed in adult, long-lived mammals.

46719 Applications of nuclear technologies for in vivo elemental analysis. Cohn, S.H.; Ellis, K.J.; Vartsky, D.; Wielopolski, L. (Brookhaven National Lab., Upton, NY). *Neurotoxicology;* **4**: No. 3, 34-47(Fal 1983).

The objectives of this Department of Energy sponsored program are (1) to improve existing nuclear techniques, and (2) to develop new techniques for the analysis and solution of both medical problems and those associated with environmental pollution. Measurement facilities developed, to date, include a unique whole body counter, (WBC); a total body neutron activation facility (TBNAA); and a partial body activation facility (PBNAA). A variation of the prompt gamma neutron activation technique for measuring total body nitrogen has been developed to study body composition of cancer patients and the effect of nutritional regimens on the composition. These new techniques provide data in numerous clinical studies not previously amenable to investigation. The development and perfection of these techniques provide unique applications of radiation and radioisotopes to the early diagnosis of certain diseases and the evaluation of therapeutic programs. The PBNAA technique has been developed and calibrated for in vivo measurement of metals. Development has gone forward on prompt gamma neutron activation for the measurement of cadmium, x-ray fluorescence (XRF) for measurement of lead, and nuclear resonance scattering (NRS) for measurement of iron. Other techniques are being investigated for in vivo measurement of metals such as silicon and beryllium. Cardinal to all toxicological studies of Cd and other metal pollutants is an accurate and sensitive noninvasive technique for measuring organ burdens. In keeping with the mission of Brookhaven, these facilities have been made available to qualified scientists and members of the medical community throughout the world.

46720 Ultraviolet-light-induced transformation of human primary cells. Sutherland, B.M. (Brookhaven National Lab., Upton, NY). pp 263-273 of Use of human cells for the evaluation of risk from physical and chemical agents. Castellani, A. (ed.). New York, NY; Plenum Publishing Corporation (1983).

In order to understand solar induction of skin cancer in man at the molecular level, a good model system is required. Several systems are presented which have been developed for this purpose. Experimental procedures are discussed for induction of transformation of human cells to anchorage-independent growth. These UV treated cells will develop into clones or colonies. The factors affecting transformation frequencies are described, as well as the properties of the transformants. Results are also presented that were obtained with rodent cells. The use of the system is explained in probing human health hazards. These in vitro systems offer great promise for probing and understanding damage to human cells at the molecular level. Development of these systems will allow a more accurate assessment of their adaptability to detection of potential carcinogens.

46721 Repair of ultraviolet-light-induced damage in human skin. Sutherland, B.M. (Brookhaven National Lab., Upton, NY). pp 197-204 of Use of human cells for the evaluation of risk from physical and chemical agents. Castellani, A. (ed.). New York, NY; Plenum Publishing Corporation (1983).

Three major new findings in the photobiology of skin are presented. First, detectable numbers of dimers are formed even at sub-erthymal doses. Second, excision of dimers is much more rapid (50% removal in 1 h) than would be predicted from results obtained in cell culture. Third, comparison of the rates of excision and photoreactivation in skin indicates that in normal sunlight exposure, photoreactivation may well be the predominant repair pathway in skin. Cells have developed two major classes of repair mechanisms for dealing with UV-induced damage to their DNA: a light-dependent, one-enzyme pathway mediated by the photoreactivating pathways. These pathways are discussed. Repair in rodent skin is also reported. Future areas of research are listed.

46722 Repair of radiation damage in mammalian cells. Setlow, R.B. (Brookhaven National Lab., Upton, NY). pp 91-104 of Use of human cells for the evaluation of risk from physical and chemical agents. Castellani, A. (ed.). New York, NY; Plenum Publishing Corporation (1983).

Photoreactivation indicates that the important damages in mammalian cells are pyrimidine dimers. DNA synthesis is inhibited by UV irradiation of cells but the blockage of replication is not complete even in excision repair defective strains. Two types of experiments have been performed to assess inter-individual variations in doses. One used the bromodeoxyuridine photolysis technique to measure excision repair in fibroblast strains from a number of persumptive normal individuals, the other measured unscheduled DNA synthesis in terms of cpm/μg of DNA in unstimulated leukocytes from a number of individuals with different lifestyles and ages. The results of the studies are presented. Studies on the molecular mechanisms for the repair of ionizing radiation damage are discussed.

46723 Mechanisms of mutagenesis for λ phage. Hutchinson, F.; Skopek, T.R.; Wood, R.D. (Yale Univ., New Haven, CT). *UCLA Symposia on Molecular and Cellular Biology, New Series;* **11**: 1-10(1983).

The principal experimental results are determination of the changes in DNA base sequence resulting from forward mutations in the cI (repressor) gene of λ phage induced by various agents. For phage irradiated with ultraviolet light and assayed in lightly irradiated host cells to induce Weigle mutagenesis (targeted mutagenesis), two-thirds of the mutations are transitions. Most transitions seem to arise at the sites of Py(6-4)Pyo photoproducts, not at the more widely studied cyclobutane pyrimidine dimers. The other mutations induced by ultraviolet are equally divided among transversions, frameshifts and double mutation events. The latter, two closely spaced base changes or a base change plus a frameshift, should rarely revert and may be the deletions induced by ultraviolet which have been previously reported. Unirradiated phage assayed in host cells heavily irradiated with ultraviolet light (nontargeted mutagenesis) show mainly frameshift mutations. These frameshifts may arise from low intracellular activity of DNA polymerase I when the enzyme binds to host DNA damaged by irradiation of the cells. Mismatch repair greatly reduced the numbers of mutations from bromouracil (which induces transitions by base mispairing) and acridines which induce frameshifts at runs of G.C base pairs). Only when mismatch repair activity is saturated by the number of improperly stacked bases in the DNA does a high level of mutagenesis occur.

46724 UV excision-repair gene transfer in Chinese Hamster Ovary (CHO) cells. MacInnes, M.A.; Bingham, J.M.; Strniste, G.F.; Thompson, L.H. (Los Alamos National Lab., NM). pp 593-602 of Cellular responses to DNA damage. New York, NY; Alan R. Liss, Inc. (1983).

UVC-sensitive mutants of CHO cells provide a model system for molecular studies of DNA repair. The authors present their recent results which show that these mutants are competent recipients for plasmid market gene transfer and incorporation of a putative CHO repair gene. The applicability and advantages of this

system for interspecies human repair gene identification are discussed.

46725 **Studies on the inhibition of repair of ultraviolet- and methyl methanesulfonate-induced damage in the DNA of human fibroblasts by novobiocin.** Snyder, R.D.; Van Houten, B.; Regan, J.D. (Oak Ridge National Lab., TN). *Nucleic Acids Research;* **10**: No. 19, 6207-6219(1982). Contract W-7405-ENG-26.

The antibiotic novbiocin is shown to alter the sedimentation properties of human cellular DNA in alkaline sucrose. This alteration is at least particularly due to increased DNA-protein binding in the cell in the presence of novobiocin. Pyrimidine dimer analysis and repair replication studies support previous reports that novobiocin inhibits repair of UV damage in human cells but the authors find this block to be short-lived. It is also shown that novbiocin is ineffective at blocking long-patch repair induced by methyl methanesulfonate as measured both by CsCl density centrifugation and the ara-C inhibition technique. However, the accumulation of breaks in MMS-treated cellular DNA in the presence of novobiocin suggests that some short-patch alkylation repair may be inhibited by the antibiotic. These findings are discussed in light of the proposal that novobiocin may inhibit a DNA gyrase-like activity in human as in bacterial cells.

5602 Thermal Effects

46726 **(DOE/EV/14377—5) Effects of cyclic temperature on larvae of marine invertebrates. Progress report, 1979-1980.** Costlow, J.D. (Duke Univ., Beaufort, NC (USA). Marine Lab.). Oct 1980. Contract AS05-76EV14377. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017209.

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The larvae of various species of marine Brachyura have been shown to exhibit a differential response to cyclic and constant temperatures, primarily in terms of survival, suggesting that rhythmic temperature patterns can extend the larva's ability to tolerate extremes of temperature and salinity and further decrease developmental variability. The components of a temperature cycle which appear to affect development are the rate of temperature change and the duration at a constant temperature. The relative importance of these two components in development seems to be species-specific. A concept has been developed (the Integrated Thermal Experience - ITE) to provide a more informative and efficient means of comparing developmental rates and survival within and between species at various combinations of cyclic temperature and salinity. 76 references, 12 figures, 6 tables.

46727 **(DOE/EV/14377—T2) Effect of cyclic temperature on larvae of marine invertebrates. Progress report, 1978-1979.** Costlow, J.D.; Bookhout, C.G. (Duke Univ., Beaufort, NC (USA). Marine Lab.). 1984. Contract AS05-76EV14377. 66p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017207.

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The larvae of various species of marine Brachyura have been shown to exhibit a differential response to cyclic and constant temperatures, primarily in term of survival, suggesting that rhythmic temperature patterns can extend the larva's ability to tolerate extremes of temperature and salinity and further decrease developmental variability. The components of a temperature cycle which appear to affect development are the rate of temperature change and the duration at a constant temperature. The relative importance of these two components in development seems to be species-specific. A concept has been developed (the Integrated Thermal Experience-ITE) to provide a more informative and efficient means of comparing developmental rates and survival within and between species at various combinations of cyclic temperature and salinity. The larval development of several species of estuarine crustaceans, molluscs and polychaetes has been studied with respect to the effects of constant and cyclic temperatures. The developmental parameters investigated were survival, duration of development, and frequency of appearance of morpholical abnormalities. The experimental temperatures include: constant temperatures at 15, 20, 25, 30, and 35 °C; cyclic temperatures of equal periodicity (COEP) at 15 to 20°C, 22 to 27°C, 25 to 30°C, and 30 to 35°C; and four additional cycles of unequal periodicity (COUP) at 30 to 35°C. Experimental salinities ranged from 5‰ to 40‰, depending on the species studied. 87 references.

46728 **(DOE/EV/14377—T3) Effect of cyclic temperature on larvae of marine invertebrates. Progress report, 1977-1978.** Costlow, J.D.; Bookhout, C.G. (Duke Univ., Beaufort, NC (USA). Marine Lab.). 1978. Contract AS05-76EV14377. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017205.

Progress is reported in research on the effects of cyclic temperatures on development of invertebrate larvae. (ACR)

46729 **(NP—4770373) Experimental investigations of the antibody production under hyperthermia of rats.** Fischer, D. (Marburg Univ. (Germany, F.R.). Fachbereich Humanmedizin). 26 Feb 1982. 53p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE84770373.

36 Sprague Pawley rats were immunised with 1 ml sheep erythrocyte suspension each. The test lasted over 14 days and was designed to compare the results with those of hypothalamus cooled animals. As in the latter thermodes had been implanted into the hypothalamus, thermodes were also implanted into the praeoptical area of the hypothalamus, for reasons of comparison. There were no significant differences between the control groups with and without thermodes. The weights of the lymphatic organs showed a significant difference in the lymph nodes only, i.e. an involution in the hyperthermia animals. Both in comparison to the control animals and to the results of the hypothalamus-cooled animals, the hyperthermia animals showed a lower amount of antibodies. It is not known yet how these antibody titers of differing sizes develop.

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 56030045403, 45488, 46272, 46549, 46566, 46585, 46590, 46590, 46590, 46591, 46591, 46591, 46592, 46592, 46592, 46593, 46593, 46593, 46606, 46613, 46629, 46680, 46712

46730 **(BNL—51741) Biological effects summary report: acridine.** Keimig, D.; Muff, S. (Brookhaven National Lab., Upton, NY (USA)). May 1984. Contract AC02-76CH00016. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017243.

A comprehensive review of acridine was conducted to assess the potential health effects of this nitorgen heterocyclic compound and to evaluate the need for recommending an interim occupational exposure limit to protect the health of exposed workers. Acridine, formed as a trace pollutant during incomplete combustion of nitrogen-containing materials, has been identified as a constituent of coal tar, coal distillates, and shale oil. Concentrations of acridine in urban and industrial settings were generally one to two orders of magnitude lower than the levels recorded for benzo(a)pyrene. In humnas, acridine is a known irritant of the skin and mocous membranes, but systemic effects attributed to acridine have actually involved exposure to either an acridine derivative or to coal-tar pitch and it is not clear whether these effects can be attributed solely, or even partly, to acridine exposures. At this time, we do not recommend that a standard be set specific to acridine, since available data on biological effects are limited, and since possible effects due to interactions of acridine and the myriad of polynuclear aromatic compounds present during typical exposures have not been assessed. 98 references, 1 figure, 8 tables.

46731 **(DOE/EV/03490—2077) Rat liver regeneration: the novel use of hepatic iron content after iron loading as a stable reference base for evaluation of the effects of chemical sympathectomy of 6-OH-dopamine.** Toribara, N.W. (Rochester Univ., NY (USA). Dept. of Radiation Biology and Biophysics). 1981. Contract AC02-76EV03490. 183p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE84016270.

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This thesis describes: (a) the development of methods to quantitate hepatic regeneration in the rat after 2/3 hepatectomy and (b) the application of these methods to assessing the effects on the regenerating liver of pretreating rats with 6-hydroxydopamine

(abbr. 60HDA), a specific sympathetic neurotoxin. A major difficulty in the investigation of hepatic regeneration has been the lack of an analytical reference standard. Experiments are described in which rats were injected with 50 mg of iron (as iron dextran) in order to iron load their livers. Stored hepatic iron was found to be stable enough to be used as a reference standard in the regenerating rat liver system. The effectiveness of 60HDA in producing a chemical sympathectomy in the rat was tested by administering ^{3}H-norepinephrine and measuring the uptake in the heart and in the liver. 60HDA was used to assess the effects of destruction of the sympathetic nervous system on the regenerative response in the partially hepatectomized rat. Variations in the size of the thymidine triphosphate (dTTP) and thymidine diphosphate (dTDP) pools, and the increase in DNA content with time after partial hepatectomy were measured using hepatic iron as a reference standard. 150 references, 20 figures, 9 tables. (ACR)

46732 **(DOE/EV/03490—2264) Action of cholera toxin in the intestinal epithelial cells.** Hyun, C.S. (Rochester Univ., NY (USA)). 1982. Contract AC02-76EV03490. 206p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE84016251.

Portions are illegible in microfiche products; Thesis.

The primary event in the action of cholera toxin on the isolated chick intestinal epithelial cell is its interaction with a large number of high affinity binding sites in the cell membrane. Binding of ^{125}I-labeled toxin is rapid, temperature-dependent, reversible, and saturable over a wide range of concentrations and includes only a small contribution from nonspecific sites. A characteristic lag phase of 10 min occurs following the complete binding of toxin before any increase in cellular cAMP levels can be detected. The response (elevation of cellular cAMP) is linear with time for 40 to 50 min and causes a six- to eight-fold increase over control levels (10 to 15 picomole cAMP/mg cellular protein) at steady state. cAMP and agents that increase cAMP production inhibit Cl^--independent Na^+ influx into the isolated enterocytes whereas chlorpromazine (CPZ) which completely abolishes toxin-induced elevation of cAMP both reverses and prevents the cAMP-mediated inhibition of Na^+ entry. Correlation between cellular cAMP levels and the magnitude of Na^+ influx provides evidence for a cAMP-mediated control of intestinal Na^+ uptake, which may represent the mechanistic basis for the antiabsorptive effect of CT on Na^+ during induction of intestinal secretion. The effect of cAMP on Na^+ but not Cl^- influx preparations can be partially explained in terms of a cAMP-regulated Na^+/H^+ neutral exchange system. Data on the coupling relationship between Na^+ transport and the intra- and extracellular pH in the enterocytes show that an amiloride-sensitive electroneutral Na^+/H^+ exchange process occurs. This coupling between Na^+ and H^+ is partially inhibited by CT and dbcAMP, suggesting that the Na^+/H^+ exchange may be a cAMP-regulated process. 31 references, 32 figures, 5 tables.

46733 **(DOE/MC/08715—T1) Effects of coal combustion and gasification process contaminants on the neuromuscular system. Final report.** Franz, G.N. (West Virginia Univ., Morgantown (USA)). 1979. Contract AT21-77MC08715. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017584.

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This study is a preliminary investigation of the possible toxic effects of flyash particles from an experimental fluidized-bed combustion process at the Morgantown Energy Research Center. Emphasis has been placed on the action of trace metals present on the surface and in the matrix of the particulates emissions, since these elements may be toxic in low dosages. In this paper the ability of cadmium to substitute for calcium at the neuromuscular junction was investigated. 20 references, 9 figures.

46734 **(FWS/OBS—80/40.11) Air Pollution and Acid Rain, Report 11. Effects of air pollution and acid rain on fish, wildlife, and their habitats: critical habitats of threatened and endangered species.** Peterson, M.A.; Adler, D. (Dynamac Corp., Rockville, MD (USA)). Jun 1982. 59p. NTIS, PC A04/MF A01 - GPO*. File Number TI84901667.

This report on Critical Habitats of threatened and endangered species is part of a series synthesizing the results of scientific research related to the effects of air pollution and acid deposition on fish and wildlife resources. General aspects of relevant legislation protecting threatened and endangered species and their habitats are described. Major stresses to these species and their supporting habitats are outlined. The bulk of this report describes potential effects of air pollution and acid rain within the following impact categories: effects on food resources, effects on physiology and breeding habitat, and effects on ecosystem structure and function. The geographical range of potential effects is briefly discussed and the report closes with a discussion of relevant topics for further research related to air pollution effects on listed species and their habitats. 51 references, 1 figure, 29 tables.

46735 **(LA-UR—84-2570) Root adaptations at stress levels of nitrate, phosphate, or both simultaneously.** Gutschick, V.P.; Kay, L.E. (Los Alamos National Lab., NM (USA)). Aug 1984. Contract W-7405-ENG-36. 8p. (CONF-8409127—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016814.

From 6. international colloquium on the optimization of plant nutrition; Montpellier, France (2 Sep 1984).

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Sunflowers in flowing hydroponic culture show reduced growth rates at nitrate levels below 10 μM nitrate or phosphate levels below 0.3 μF. At least for phosphate, this level is a very small fraction (0.003) of the K/sub m/ for the uptake systems. We have quantified four major adaptations that enable high growth rates under incipient stress: increased root:shoot ratio; increased uptake capacity (V/sub max/) per unit root mass; nocturnal uptake of nutrients; and (only partially adaptive) reduced tissue concentrations of nutrients. We show that capital energy costs (in root growth) for acquiring nutrients can exceed direct or operational costs of internal metabolism (nitrate reduction, e.g.,); this has implications for the plant-controlled trade-off of NO_3^--NH_4^+ - N_2 as N sources for legumes and other plant types. We outline needed further research and suggest guidelines for breeding plants for tolerating nutritional stresses; we also suggest that some measures of nutrient-use efficiency may be misleading. 6 references, 2 figures, 2 tables.

46736 (LMF—107, pp 298-302) **Pulmonary procoagulant activity of dogs with lung tumors.** Galvin, J.; Bice, D.E.; Muggenburg, B.A. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

This study evaluated the procoagulant activity and spontaneous macrophage migration of lung lavage cells from: a) dog lung lobes that had radiographically proven lung tumors, b) lobes without tumors in the same dogs, and c) control dog lungs with no detectable lung masses. These dog lungs were lavaged, the cell fraction and wash fluid were assayed for procoagulant activity, and the spontaneous migration of bronchial wash cells was measured. The procoagulant activity of the cells and fluid washed from the lung lobe with a tumor was significantly increased over that of both sets of the control lung lobes. The spontaneous migration area of cells from the tumor lobe was significantly greater than that of cells from both sets of control lung lobes.

46737 (LMF—107, pp 363-371) **Human risk relationships derived from epidemiology and laboratory studies.** Cuddihy, R.G.; Boecker, B.B.; Hahn, F.F.; McClellan, R.O. Dec 1983. NTIS, PC A21/MF A01. File Number TI84012996.

In Inhalation Toxicology Research Institute annual report, October 1, 1982-September 30, 1983.

Proven techniques are needed for incorporating the results of laboratory toxicology studies into human risk assessments. Two sample calculations of lung cancer risk factors for inhaled radioactive particles and diesel engine exhaust are given here to illustrate a toxicology information matrix approach. This approach combines the results of epidemiology and laboratory animal studies of the substance or agent of principal concern, along with similar information on other surrogate substances. Beyond the estimates of lung cancer risk factors derived by using this approach, an additional advantage is gained by having estimates of uncertainty that can be obtained by incorporating all available toxicology information into the

analysis. This approach is recommended for both risk assessment and in designing follow-on toxicology studies to improve preliminary assessments for new potentially harmful agents entering our environment.

46738 **(N—84-13375) US-Japan cooperative research on evaluation of toxicity.** Yusa, S.; Saito, F.; Yoshida, M. (Building Research Inst., Tokyo (Japan)). 1982. 9p. NTIS, PC A99/MF A01.

The sensitivity of toxicity in mice and rats from the combustion products of Douglas fir, acrylic carpet, and particle board was examined. Experiments conducted using the Japanese method yielded results which contradict those obtained from using the NBS method. The cause of this may be the difference in the process of forming the combustion product. Accordingly, the atmospheric oxygen condition for combustion may affect the formation of effluent products.

46739 **(N—84-13376) Physiological function of combustion gas and especially that of CN.** Nishimaru, Y.; Tsuda, Y. (Yokohama City Univ. (Japan)). 1982. 6p. NTIS, PC A99/MF A01.

When cyanide is absorbed and enters the blood stream, functions of the oxiginate ferment are suppressed in internal organs and tissues cells. The oxygen in blood is prevented from being consumed. The CN immediately unites with ferments such as cytochrome and interferes with their functions. In examples of death due to cyanide poisoning, cyanide hemoglobin is sometimes detected but it is now thought the CNHb probably does not function as a blood poison. A minute quantity of CN causes stimulation of the central nervous sytem but paralysis occurs immediately after. The respiratory functions are most easily affected, then the vasomotor and convulsion centers. There is evidence that CN also causes myocardial infarction. Research is neaded to determine how much of the damages done by CN, which is more poisonous than CO, is reversible.

46740 **(NP—4770375) Applicability of municipal waste composts under the aspect of enrichment of lead, cadmium and zinc in the soil and in vegetable plants.** Kazemi, A. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Landschaftsentwicklung; Technische Univ. Muenchen, Freising (Germany, F.R.). Inst. fuer Chemie). 1983. 139p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE84770375.

The influence of one-time administering of refuse sewage sludge (RSS) or refuse compost (RC), resp., on head lettuce and kohlrabi and on the soil was tested in container experiments. Physical and chemical parameters were established for the soil and the applied refuse composts. Pb, Cd and Zn concentrations were determined by means of AAS. Different from kohlrabi, lettuce reacts strongly to RSS or RC admixtures to the soil; yield and quality are diminished mainly by the salt concentrations of the composts. The plant species and parts studied possess a different capacity for enriching Pb, Cd and Zn. Except for one instance, the single admixture of RSS or RC did not reach the limit values determined for soils by the sewage sludge regulation; contamination, however, varied in magnitude depending on the original heavy-metal concentration of the composts. Statistical evidence of migration was found for zinc only. There is a danger of heavy-metal enrichment in soils following repeated administering of RSS or RC. This is to be borne in mind with areas mainly dedicated to foodstuff and forage production and whose limit values are regulated by law.

46741 **(NP—4901952) Study of a naturally occurring hydrilla inhibitor. Final report.** Martin, D.F. (University of South Florida, Tampa (USA). Chemical and Environmental Management Center). Mar 1983. 41p. NTIS, PC A03/MF A01. File Number TI84901952.

An investigation was made of sediment from Lake Starvation (northwest Hillsborough County, Florida) where hydrilla, though present, has not spread during a 10-year period. The sediment was treated with water, autoclaved, and the aqueous extracts separated into molecular weight fractions by ultrafiltration. One fraction, thus obtained, inhibited the growth of hydrilla by 30%. The active fraction was characterized by inorganic and organic content, as well as trace metal content (iron, manganese, nickel, and cadmium). Subsequently, the active fraction was separated further using high-performance liquid chromatography, and the components thus separated were characterized by ultraviolet absorption spectra and by their effect on the size distribution of Chlamydomonas reinhardii. One component that showed significant bioactivity according to this assay was subjected to mass spectrometry. The maximum molecular ion for this component was less than 500. The available evidence is consistent with an aromatic molecule that contains a carboxylic acid. Further evidence includes the infrared spectra and the observation that all activity was lost when the sample was passed over an anion-exchange resin, whereas no activity was lost when the sample was passed over a cation-exchange resin. 13 references, 11 figures.

46742 **(PB—84-192046) Pretreatment and ozonation of cooling tower water: part 2. Technical report.** Krofta, M.; Wang, L.K.; Kurylko, L.; Thayer, A.E. (Lenox Inst. for Research, Inc., MA (USA)). 5 Aug 1983. 32p. NTIS, PC A03/MF A01.

Laboratory treatment of the sample involving Dissolved Air Flotation (DAF) pretreatment and in line ozonation was performed on a sample of recirculating cooling tower water that was obtained from Transo Envelope Company of Jersey City, NJ. Various parameters including turbidity, color, pH, total hardness, TOC, and bacteria levels as well as specific concentrations of constituents such as iron and copper were monitored. After each stage of experimentation various parameters were measured to determine optimum treatment for the specific water. Ozonation in combination with DAF pretreatment produced optimum water quality with the DAF pretreatment being responsible for most of the water quality improvement. Ozonation was found to be necessary for bacteria removal. Operating cost estimates are included and compared to those of a conventional system of chemical treatment.

46743 **Comparative acute toxicity to aquatic organisms of components of coal-derived synthetic fuels.** Millemann, R.E.; Birge, W.J.; Black, J.A.; Cushman, R.M.; Daniels, K.L.; Franco, P.J.; Giddings, J.M.; McCarthy, J.F.; Stewart, A.J. (Oak Ridge National Lab., TN). *Transactions of the American Fisheries Society;* **113**: No. 1, 74-85(Jan 1984). Contract W-7405-ENG-26.

In acute toxicity tests, green algae Selenaastrum capricornutum, diatoms Nitzschia palea, adult snails Physa gyrina, juvenile cladocerans Daphnia magna, larval midges Chironomus tentans, adult amphipods Gammarus minus, juvenile fathead minnows Pimephales promelas, and embryo-larva stages of rainbow trout Salmo gairdneri and largemouth bass Micropterus salmoides were exposed for 4 hours (algae), 48 hours (arthropods and snails), 96 hours (fathead minnows), 7 days (large-mouth bass), and 27 days (rainbow trout) to two phenols (phenol and β-naphthol), two azaarenes (quinoline and acridine), and two polycyclic aromatic hydrocarbons (naphthalene and phenanthrene) present in coal-derived oils. Median lethal or median effective concentrations (LC50s or EC50s) ranged from 0.03 mg/liter for phenanthrene and rainbow trout to 286.54 mg/liter for phenol and the green alga. The rainbow trout embryo-larva assay was the most sensitive of the test systems to all the chemicals except quinoline. For this last compound, systems with juvenile fathead minnows and largemouth bass embryos were the most sensitive. As test systems, fish embryos and larvae were the most sensitive, juvenile fathead minnows and arthropods had intermediate sensitivity, and algae and snails were the most resistant to the test compounds under the test conditions. Within each chemical class (phenols, azaarenes, and polycylcic aromatic hydrocarbons), toxicity increased with increased ring number except for the reversed relationship with the azaarenes and fathead minnows. Thus, β-naphthol (two rings) was 2 to 45 times more toxic than phenol (one ring); acridine (three rings) was 7 to 27 times more toxic than quinoline (two rings); and phenanthrene (three rings) was 3 to 9 times more toxic than naphthalene (two rings). 50 references.

46744 **Acute toxicity of a synthetic oil, aniline and phenol to laboratory and natural populations of chironomid (diptera) larvae.** Franco, P.J.; Daniels, K.L.; Cushman, R.M.; Kazlow, G.A. (Oak Ridge National Lab., TN). *Environmental Pollution;* **34**: No. 4, 321-331(1984).

The acute toxicity of a water-soluble fraction of a coal-derived oil and two of its components, aniline and phenol, to larvae of four chironomid species was determined in 48-h bioassays. Three species, Clinotanypus pinguis, Einfeldia natchitocheae and Tanypus neopunctipennis, were collected from natural populations and the fourth, Chironomus tentans, was reared in laboratory culture. Bioassay data were examined using weighted least squares and probit analyses. The LC_{50} values calculated from regression equations of the water-soluble fraction ranged from 1.1% for E. natchitocheae to 2.0% for C. pinguis; for aniline, 287 mg litre^{-1} for T. neopunctipennis to 442 mg litre^{-1} for E. natchitocheae; and for phenol, 73 mg litre^{-1} for T. neopunctipennis to 187 mg litre^{-1} for C. tentans. Comparisons from sensitivity analyses revealed that the closer the taxonomic relationship between species, the more similar the response to a given toxicant. The data suggest that the laboratory population may be representative of natural midge populations in bioassays.

46745 **Pulmonary effects of shale dusts in experimental animals.** Holland, L.M.; Gonzales, M.; Wilson, J.S.; Tillery, M.I. (Los Alamos National Lab., NM). pp 485-496 of Health issues related to metal and nonmetallic mining. Wagner, W.L.; Rom, W.N.; Merchant, J.A. (eds.). Woburn, MA; Butterworth Publishers (1983).

An overview is presented of the current status of ongoing studies of the potential pulmonary effects of shale oil extraction. A number of experiments were performed to determine the effects of shale dusts on lung tissue of hamsters and rats. The hamsters were exposed by inhalation to nominal concentrations of 50 mg/m^3 (respirable fraction) of spent shales. Rats also were exposed by inhalation to concentrations of 90 mg/m^3. The principal finding in hamsters exposed by this method was a pneumonitis-pneumonia complex that occurred late in the exposure period. Signs of fibrosis were minimal, and no lung tumors have been observed to date. Rats exposed to the same doses and materials, however, exhibited both fibrosis and a number of lung tumors.

46746 **Repair of chemical damage in mammalian cells.** Setlow, R.B. (Brookhaven National Lab., Upton, NY). pp 169-177 of Use of human cells for the evaluation of risk from physical and chemical agents. Castellani, A. (ed.). New York, NY; Plenum Publishing Corporation (1983).

The repair of chemical damage to DNA differs from the repair of radiation damage. The dosimetry of chemicals is complicated and may vary markedly from tissue to tissue, organelle to organelle or from linker to the core region of DNA. The ways in which chemical agents mimic UV irradiation are discussed. Three possible pathways of base excision repair are shown. The experimental evidence indicating the important role played by O^6-alkylguanine in mutagenesis and carcinogenesis involves numerous animal experiments on the production and repair of various alkylation products in DNA in different tissues as a result of acute and chronic administration of alkylating agents. Experiments dealing with human cells indicate that they may be classified as either proficient in the repair of methyl damage (Mer^+) or deficient (Mer^-) in its repair after treatment with dimethylnitrosamine.

46747 **Problems of toxicological testing of complex mixtures.** Witschi, H.R.; Munro, N.B. (Oak Ridge National Lab., TN). pp 3-11 of Developments in the science and practice of toxicology. Hayes, A.W.; Schnell, R.C.; Miya, T.S. (eds.). Amsterdam, Netherlands; Elsevier Science Publishers B.V. (1983). Contract W-7405-ENG-26.

Health effects associated with the synthetic fuel industry are presented. The following points are discussed in relation to toxicological testing: data is needed in order to assess risk or safety of new synthetic fuels; the need for generic testing; sensitivity of toxicological endpoints; complexity of test materials; exposure of animals to complex mixtures; and toxicological interactions. Some of the problems will be solved by the testing approach, but more should be done to understand disease processes.

46748 **Genotoxicity induced in cultured Chinese hamster cells exposed to natural or synthetic crude oils and near ultraviolet light.** Strniste, G.F.; Bingham, J.M.; Okinaka, R.T.; Chen, D.J. (Los Alamos National Lab., NM). *Toxicology Letters;* **13**: 163-167(1982).

Cultured Chinese hamster ovary (CHO) cells were incubated with dilutions of natural or synthetic crude oils and subsequently exposed to near ultraviolet light (NUV). Although the magnitude of photoinduced cytotoxicity in CHO was essentially independent of the source of the oil (within a factor of two), two shale oils were exceptionally high in photo-induced mutagenic activity eliciting a response 10-12 times the observed natural background mutation frequency. Other shale oils, natural crude oils and a solvent refined coal medium distillate blend were weaker or negative in photo-induced mutagenic activity. Hydrotreatment of a photoactive shale oil, although eliminating the mutagenic potential, did not reduce the oil's cytotoxic potential.

46749 **Effect of application frequency on epidermal carcinogenesis assays.** Wilson, J.S.; Holland, L.M. (Los Alamos National Lab., NM). *Toxicology;* **24**: 45-53(1982).

Classic mouse skin-painting assays of such highly-complex mixtures as petroleums and synthetic fuels may lead to severe local cytotoxic effects that can alter tumorigenesis. The experiments described here illustrate that frequency of exposure may be more important than the concentration of individual doses. C3Hf/Bd mice were exposed to 2 shale oils in experiments in which a constant weekly dose was either applied once or divided into 2 or 4 equal parts and applied either twice or 4 times each week. In experiments with either oil, a single weekly application was more effective in total tumor production and less cytotoxic than more frequent application of less-concentrated doses.

46750 **Nonciliated bronchiolar epithelial (Clara) cell necrosis induced by organometallic carbonyl compounds.** Haschek, W.M.; Hakkinen, P.J.; Witschi, H.P.; Hanzlik, R.P.; Traiger, G.J. (Oak Ridge National Lab., TN). *Toxicology Letters;* **14**: 85-92(1982). Contract W-7405-ENG-26.

The administration of transition metal organometallic compounds such as manganese, chromium, and iron carbonyls by the i.p. route, and nickel by inhalation (mice) or intravenously (rats), resulted in selective necrosis of the nonciliated bronchiolar epithelial (Clara) cells and variable pulmonary parenchymal damage in BALB/c mice and Fischer-derived rats within 24 h of administration. The pulmonary toxicity of methylcyclopentadienyl manganese tricarbonly (MMT), a representative of this group of compounds, was enhanced by pretreatment with piperonly butoxide (PB), an inhibitor of the mixed-function oxidase system. This finding suggests that Clara cell necrosis can result from direct toxicity and that the specificity of toxic agents for Clara cells may not be related solely to the presence of the mixed-function oxidase system.

46751 **Foliar response of ten tree species exposed to SO_2 air pollution.** Biggs, A.R.; Davis, D.D. University Park, PA; Pennsylvania State University (1981). 3p. Pennsylvania State Univ., College of Agriculture, Agricultural Experiment Station, University Park, PA 16802. Contract AC02-77EV04497.

A study on the relative susceptibility to SO_2 damage among 4 birch species - Scotch, Austrian, and eastern white pines, white ash, black cherry, and hybrid poplar - is reported. Controlled exposures were performed and the percentages of plants injured and the percentages of leaf areas damaged were recorded.

46752 **Foliar responses that may determine plant injury by simulated acid rain.** Evans, L.S. (Manhattan Coll., Bronx, NY). pp 239-257 of Polluted rain. Toribara, T.Y.; Miller, M.W.; Morrow, P.E. (eds.). New York, NY; Plenum Publishing Corporation (1980). Contract AC02-76CH00016.

Experiments were performed to categorize the responses of foliage of several plant species after exposure to simulated acid rain in order to predict the relative sensitivities of plants to acid precipitation in nature. The present investigations were performed to (1) identify leaf indumentum response, (2) determine histological responses, and (3) determine whole plant and individual leaf re-

sponses that may be used to diagnose acid rain injury. Plants were exposed to simulated rain at pH levels of 5.7, 3.4, 3.1, 2.9, 2.7, 2.5, and 2.3. Sporophyte leaves of bracken fern (P. aquilinum) and foliage of pinto bean, soybeans, and sunflower were most sensitive to simulated acid rain among the species tested. About 5% of the surface area of older leaves of sunflower, soybeans, and pinto beans was injured after exposure to 4 rainfalls at pH 2.5 (a single-six min rainfall every four days). Foliage of pin oak (Q. palustris) exhibited less than 1% leaf area injury after exposure to simulated rain at pH 2.5 after 10 rainfalls (one-twenty min rainfall daily). The responses of poplar (Poplus sp.) and spiderwort (Tradescantia sp.) were intermediate between these two extremes. Histological observations show that lesion development results in collapsed leaf tissue in most sensitive species. Gall formation that resulted from both cell hypertrophy and hyperplasia occurred in lesions of spiderwort, poplar, and oak. Limited hyperplastic and hypertrophic reactions occurred in soybean foliage after exposure to simulated acid rain but no leaf galls resulted. Sporophyte foliage of P. aquilinum and leaves of pinto bean and sunflower exhibited neither hyperplasia nor hypertrophy after exposure to simulated acid rain. Injury occurred most frequently near vascular tissues and trichomes in all species.

5604 Other Environmental Pollutant Effects

46753 **(IFIN-RB—11-1983) Erythrocytes in alternating electric fields.** Morariu, V.V.; Chifu, A.; Simplaceanu, T.; Frangopol, P.T. (Institutul Central de Fizica, Bucharest (Romania)). Feb 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702937.

The elastic and inelastic deformation of erythrocytes induced by alternating fields and the suggestion that moderate field intensities (1.2 kV/cm) when continuously applied can cause lysis by a different mechanism compared to the action of short intense field pulses is presented. The different experimental conditions can be used to approach various properties of the membrane such as those related to the dielectric polarization of the membrane or to the interfacial polarization, leading to the inelastic deformation of the cells.

46754 **(NP—4770388) Influence of aircraft noise on bovine pregnancy with special regard to endocrinological and physiological factors.** Heuwieser, W. (Tieraerztliche Hochschule Hannover (Germany, F.R.)). 22--24 Jun 1982. 115p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84770388.

Five highly pregnant cows and heifers have each been exposed to aircraft noise (defined by frequency, duration and steepness) consisting of a total of 59 overflights by six different aircraft models. The values of the following parameters were recorded: - heart frequency, respiratory frequency and locomotion activity, - progesterone concentration and estrogen concentration, - in addition pathological and bacteriological examinations of the foetus, and cotyledons were conducted in the cases where abortion occurred. The following conclusions can be drawn from the results: - effects varied with aircraft model, the variation being greater with tachycardies than for example with respiratory frequency and locomotion activity, - three cases of abortion were observed, and the changes in the reproduction hormones in some other cases showed a tendency to abortion, - further experiments are necessary to determine the exact relationship between single flights and the tendency to abortion.

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 57000046622, 46737

46755 **(LA—10156-MS) Acceptance-testing procedures for air-line supplied-air suits.** Bradley, O.D. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016980.

Procedures and requirements have been established to permit the Department of Energy contractors to submit needed air-line supplied-air suits for testing and evaluation. The testing is to be conducted by the Personnel Protection Studies Section, Industrial Hygiene Group, of the Los Alamos National Laboratory. The adequacy of performance, recommendations for improvement and/or operational restrictions of the devices are to be made by the Department of Energy Contractors' Respirator Advisory Committee. The responsibility of acceptance or nonacceptance of these devices will be with the Department of Safety, Office of Operational Safety. The test equipment, test methods, design, and performance criteria for air-line supplied-air suits are prescribed.

46756 **(UCID—20158) Safety evaluation of a new proposed standard laboratory coat.** Pane, A.J. (Lawrence Livermore National Lab., CA (USA)). Jul 1984. Contract W-7405-ENG-48. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017605.

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A proposed disposable laboratory coat was destructively tested and compared to the present coat. Tests included flame, acids, bases, solvents, exploding glass, allergic reactions, dust penetration, and tensile properties. (ACR)

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 58010045417, 45595, 45602, 45649, 45658, 46605

46757 (CONF-8203181—Summs., pp 2) **Oriskany sandstone in the subsurface of Pennsylvania.** Abel, K.D. (Pennsylvania Geological Survey, Pittsburgh). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

46758 (CONF-8203181—Summs., pp 14-18) **Shelf, paralic, and fluvial environments and eustatic sea level fluctuations in the origin of the Tuscarora Formation (Lower Silurian) of central Pennsylvania.** Cotter, E. (Bucknell Univ., Lewisburg, PA). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

46759 **(DOE/EV/10680—T2) Dendrochronology of bristlecone pine. Final technical report, 1 May 1981-31 October 1982.** Ferguson, C.W.; Graybill, D.A. (Arizona Univ., Tucson (USA). Lab. of Tree-Ring Research). 1 Aug 1984. Contract AC02-81EV10680. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016244.

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The primary objectives of this research were: (1) to extend the bristlecone pine chronology from the White Mountains of California beyond 6700 B.C. and strengthen it by incorporating additional specimens; (2) to develop bristlecone pine chronologies in new areas for applications in archeology, isotopic and studies, and other sciences; and (3) to furnish dendiochronology dated wood to researchers engaged in the study of past variations in carbon isotopes and climate. Areas studied include: White Mountain, Ca.; Indian Garden and Mount Jefferson, Nev.; and Mammoth Creek, Utah. 2 references, 12 tables.

46760 **(FAO-AG/DP/GRE—77/023-Vol.1) Water resources development in the Molai area, Greece.** (Food and Agriculture Organization of the United Nations, Rome (Italy); United Nations Development Programme). 1981. 228p. NTIS (US Sales Only), PC A11/MF A01; Also available from FAO 8218413. File Number DE84702929.

The first volume of this report describes the work, carried out by the Government of Greece, with the assistance of UNDP and FAO, to assess the availability of groundwater for the irrigation of up to 6000 km in the Molai plain, located in the southern Peloponnese. The limestone reservoir of groundwater is restricted to the area 10 km^2. Its groundwater is of rather poor quality (EC

more than 2.0 mmho/cm) and it has a low head 3-7 m above sea level, which is 77-150 m below land surface. A water balance is presented which has been confirmed on a groundwater model. The fresh water of the limestone aquifer is characterised by the admixture of a variable amount of sea-water. The water of the Neogene aquifer is of much better quality. Combining the available resources, the irrigated area in the Molai plain can be tripled to cover half the net irrigable area. The economic feasibility of such a project has been studied.

46761 **(FAO-AG/DP/GRE—77/023-Vol.2) Water resources development in the Molai area, Greece.** (Food and Agriculture Organization of the United Nations, Rome (Italy); United Nations Development Programme). 1981. 262p. NTIS (US Sales Only), PC A12/MF A01. File Number DE84702930.

The report describes the work, carried out by the Government of Greece, with the assistance of UNDP and FAO, to assess the availability of groundwater for the irrigation of up to 6000 ha in the Molai plain, located in the southern Peloponnese. The second volume of this report consists of appendixes to the first volume. Appendixes are concerned with the post-project data collection programme, boreholes in the Molai area, identification of springs, water well inventory, groundwater study techniques, chemical analysis of ground and surface waters, adjusted sodium adsorption ratio, results of project evaluation, estimated cost of one exploitation borehole, agricultural data, electricity costs, farmgate prices in Molai area and improvement of existing olive trees. The stable isotope composition of the water discharged by the coastal springs and by selected wells was used to determine their mean recharge elevation. Tritium and carbon 14 content was used to determine the age of water. A tracing experiment was carried out to determine the subsurface flow pattern of the water.

46762 (IAEA-TECDOC—298, pp 31-47) **^{210}Pb technique for dating sediments, and some applications.** Eakins, J.D. (UKAEA Atomic Energy Research Establishment, Harwell. Environmental and Medical Sciences Div.). Oct 1983. NTIS (US Sales Only), PC A05/MF A01. File Number TI84780553. (CONF-821284—).

From IAEA meeting on radioisotopes in sediment studies; Vienna, Austria (13 Dec 1982).

The use of ^{210}Pb for dating sediment in time scale 100-150 years is described. Various methods of determination of ^{210}Pb concentration are reviewed and the problem of the initial ^{210}Pb concentration using two models for interpretation of data is discussed.

46763 **(LA—9445-PNTX-A) Supplementary documentation for an Environmental Impact Statement regarding the Pantex Plant: hydrologic study for Pantex.** Becker, N.M.; Purtymun, W.D. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 68p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84008061.

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This report docuents work performed in support of preparation of an Environmental Impact Statement (EIS) regarding the Department of Energy's Pantex Plant, near Amarillo, Texas. Drainage patterns and drainage diversion at the Pantex Plant and Texas Tech University Research Farm have been delineated. Rainfall-runoff relations for the 6- and 24-hour storms were investigated using historical data. Resultant flooding onsite from these storms was computed. Culvert sizes in Zones 11 and 12 were investigated to determine an adequate design size to carry storm water runoff. Erosion and soil loss rates were computed for wheat crops and native grasses and related to potential for contaminant transport.

46764 **(LA-UR—84-2114) Rio Grande rift: problems and perspectives.** Baldridge, W.S.; Olsen, K.H.; Callender, J.F. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 48p. (CONF-8410128—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84015492.

From 35. annual conference of the New Mexico Geological Society; Taos, NM, USA (10 Oct 1984).

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Topics and ideas addressed include: (1) the regional extent of the Rio Grande rift; (2) the structure of the crust and upper mantle; (3) whether the evidence for an axile dike in the lower crust is compelling; (4) the nature of faulting and extension in the crust; and (5) the structural and magmatic development of the rift. 88 references, 5 figures.

46765 (LBL—15500, pp 35-64) **Geomechanics.** Sep 1983. NTIS, PC A13/MF A01. File Number TI84003916. Contract AC03-76SF00098.

In Earth Sciences Division annual report, 1982.

Research topics include techniques in rock excavation, mine ventilation, the behavior of rock-fluid systems at elevated temperatures and pressures, fracture characterization in rock masses by borehole geophysics, and the measurement of in situ stress. An improved technique involving water-jet-assisted rock cutting is described in a series of articles on rock excavation, together with investigations of the mechanisms involved in the rock-cutting process. The efficiency and economics of mine ventilation systems are discussed and the results of modeling studies and case histories are summarized. Progress on the development of a multiproperties measurement system is highlighted in a report on the behavior of rock-fluid systems at elevated temperatures and pressures. The effects of fractures intersecting a borehole upon acoustic wave propagation in the borehole are summarized. Recommendations are presented for stress measurement programs in hard rock repository sites made on the basis of the results of an extensive program for comparing different methods of in situ stress measurement in a granitic rock mass.

46766 **(SKBF-KBS-TR—83-15) Diffusion measurements in crystalline rocks.** Skagius, K.; Neretnieks, I. (Svensk Kaernbraensleforsoerjning AB, Stockholm). Mar 1983. 43p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702918.

The diffusion of non-sorbing species in different rock materials and fissure coating materials have been studied on a laboratory scale. The non-sorbing species were iodide, Uranine and Cr-EDTA. The results show that the effective diffusivity for iodide in granites with fissure coating material is of the same magnitude or higher as the effective diffusivity for iodide in granites without fissure coating material. The results also show that it is difficult to give just one value of the diffusivity in a rock material from a certain area because of the variations in the rock material. The effective diffusivity for iodide in rock materials without fissure coating material was determined to be from 1 times 10^{-14}m^2/s to about 7 times 10^{-13}m^2/s. Electrical resistivity measurements in salt-water-saturated rock cores which are under pressure have been performed. The resistivity is measured in the saturated core at various pressures, and in the salt solution with which the core has been saturated. The ratio between these two resistivities has a direct relation to the ratio of the effective diffusivity for a component in the rock material and the diffusivity in free water for the same component. Results from two measurements are presented and they show that the effective diffusivity is reduced by about 60 percent at 230-240 bar from the value at atmospheric pressure. More experiments must be made before any conclusions can be drawn.

5802 Geophysics

REFER ALSO TO CITATION(S) 58020045527

46767 **(AAEC/E—581) Effect of the bore hole on nuclear logging measurements.** McGregor, B.J.; Eisler, P. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Dec 1983. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702917.

An analytical study, with sand representing an ore, was undertaken to find whether the ratio of the characteristic gamma-ray flux to thermal neutron flux in a bore hole can be reliably used as a measure of the characteristic element, particularly if the water content of the ore is unknown. Both Monte Carlo and two-dimensional transport theory methods were used and found to be in good agreement, but the use of two-dimensional transport theory is preferred for speed. A homogeneous analysis, which ignores the effect of the bore hole and probe, is compared to the detailed representation. It is shown that, when the bore and probe are represented in the anal-

ysis, there is a significant variation with water content of the ratio of the characteristic gamma-ray flux to the thermal neutron flux. This variation is not accurately predicted by the homogeneous model, which is therefore inadequate.

46768 (CONF-8203181—Summs., pp 31) **Central Appalachian mega-thrust system as outlined by seismic reflection data.** Harris, L.D.; Bayer, K.C.; de Witt, W. Jr. (US Geological Survey, Reston, VA). 1982. NTIS, PC A05/MF A01. File Number TI84901146.

From 13. annual Appalachian petroleum geology symposium; Morgantown, WV, USA (9 Mar 1982).

46769 **(HIG—80-8) Source of the tsunami associated with the Kalapana (Hawaii) earthquake of November 1975.** Cox, D.C. (Hawaii Univ., Honolulu (USA). Hawaii Inst. of Geophysics). Dec 1980. 51p. NTIS, PC A04/MF A01. File Number DE84901908.

The travel times of the tsunami generated on 29 November 1975 off the Kau-Puna coast of Hawaii to the tide gages at Hilo, Kahului, Honolulu, and Nawiliwili have been calculated from the arrival times indicated on the tide-gage records, applying gage-time corrections, assuming that the tsunami was generated at the time of the earthquake it accompanied. Travel times have also been calculated similarly to other places on the coast of Hawaii where arrival times of the tsunami were reported, and to Johnston Atoll. Inverse tsunami refraction diagrams have been constructed by graphical means for the path of the tsunami between the vicinity of its source and the places of known arrival times. The isochrones of the refraction diagrams corresponding to the respective calculated travel times for the tsunami front have been used to define the boundary of the area of upward sea-floor displacement from which the tsunami propagated. This area is about 15 or 20 miles long (parallel to the southeast coast of Hawaii) and on the order of 14 or 15 miles wide, considerably smaller than the area earlier considered the tsunami source. Coastal subsidence measured soon after the earthquake indicates that the area of initial upward displacement was separated from the coast by a narrow belt of downward displacement. Comparisons between the crest arrival times and the travel times indicated by the inverse refraction diagrams indicate a lag of about four minutes between the time of the earthquake and the accomplishment of the maximum upward displacement. Accuracies of estimation are insufficient to determine whether the maximum upward displacement occurred within the area of initial displacement or seaward of it within a distance of about 15 miles. Displacement resulting from a mega-landslide cannot be distinguished from strictly tectonic displacement by the comparison of arrival times and travel times. 14 references, 19 figures, 8 tables.

46770 **(LA—10139-PR) Earthquake catalog for northern New Mexico. Progress report, April-June 1982.** Cash, D.J.; Olsen, K.H.; Stewart, J.N.; Wolff, J.J. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016984.

This report is a summary of the earthquakes located in northern New Mexico by the Los Alamos National Laboratory seismic array. Data are presented in the form of tables and epicenter maps, with a brief explanatory text. 6 references, 4 figures, 2 tables.

46771 (LBL—15500, pp 3-33) **Geophysics.** Sep 1983. NTIS, PC A13/MF A01. File Number TI84003916. Contract AC03-76SF00098.

In Earth Sciences Division annual report, 1982.

Geophysical research summaries are included for the following: determination of correlation lengths for magnetic noise in magnetotellurics; topographic stripping for magnetotelluric data interpretation; hybrid modeling modifications for magnetotelluric data interpretation; automated seismic processing capability; a 2 1/2 dimensional numerical solution for the electromagnetic scattering using a hybrid technique; electromagnetic sounding for geothermal resource delineation in Dixie Valley, Nevada; and deep electromagnetic sounding in Central Nevada.

46772 (NP—4770405, pp 271-282) **Further development of magnetotellurics for prezechstein exploration through improvement of data processing, data acquisition and interpretation technique.** Knoedel, K.; Losecke, W.; Mueller, W.; Rodemann, H. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

With this project, method improvement of magnetotellurics (MT) is strived for with two major objectives: I) acceleration of measuring procedure for industrial application, II) enhancement of statement reliability e.g. by reducing interferences. The results obtained with the project will be applied with the pre-zechstein exploration in the North German sedimentation basin, with the detection of plutones in areas envisaged for hydrocarbon prospection and with the exploration of sediment packages under alpine and volcanic caps. The article presents the substantially improved and extended magnetotelluric measuring system and the concomitant programme package for data acquisition and processing as the results of the finished research project.

46773 (NP—4770405, pp 321-332) **ISAS interactive seismic evaluation system.** Rosenbach, G.; Sattlegger, J. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

The procedure aims at applying the principles of downward continuation (step-by-step lowering of reference level) and of seismic stripping (step-by-step coverage of formations) in order to provide for stepwise processing and evaluation; to give the evaluator a clear idea of the effect of various possible intepretations of seismic data on the intermediate result concerned; to allow evaluation and modification of the evaluation within the result area, i.e. in the (s,z,v)-area (profile co-ordinate, deepness, interval velocity).

46774 (NP—4770405, pp 333-342) **Inverse model procedure for analysing seismic horizons.** Dohr, G. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

INMOD is a procedure which is applied after standard processing and an initial evaluation of a seismic profile. Based on the summing times of the evaluated horizons and the rms velocities known through standard processing, the pulses contributing to the evaluated horizons are searched for in the single traces. In the ANAKON partial programme, the rms velocities are continuously determined and demonstrated graphically for each CDP. Simultaneously, ANAKON is the basis of the actual INMOD programme with which interval velocities corrected refractionally are calculated from the summing times of the pulses via an inverse model procedure.

46775 (NP—4770405, pp 343-352) **IMF - inverse model procedure for area-wise recorded seismic data.** Sattlegger, J. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

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IMF is the follow-up project to the INMOD project (O3E-3018-A, inverse model procedure for analysing seismic horizons). Within IMF, the two-dimensional procedure of INMOD is to be improved and extended to area-wise registered seismic data. Since the beginning of the project, activities have exclusively been dedicated to improving the two-dimensional procedure of horizon analysis and the two-dimensional inverse model procedure.

46776 (NP—4770405, pp 353-378) **Absorption of seismic waves (ASW).** Behrmann, R.B.; Engelhard, L.; Theilen, F. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

The research project aims at a contribution to making absorption of seismic waves quantitatively available as an additional

lithological parameter in the evaluation of seismic signals via the quality factor Q^{-1} of the absorption attenuation. In the individual partial projects, it is planned to analyse and evaluate methodically those information on the physical properties of the basement - esp. the inelastic ones - which are contained in the amplitudes and frequency spectra of seismic signals. Individual reserach workers, will adopt different approaches to a solution of the problems, like determination of absorption by in situ measurements and comparisons with studies on synthetic seismograms; bench-scale and model seismic examinations of the issue of absorption interpretation; theoretical activities concerning absorption causes.

46777 (NP—4770405, pp 379-398) **Improvement of seismic exploration methods for digital seismogram processing by including the seismic signal.** Marschall, R. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

The project aims at obtaining an improvement of structure recognition and structure interpretation through consequent inclusion of the seismic signal in seismogram processing. As already mentioned in the 1980 report on the state, the available seismic frequency bandwidth is an important parameter along with the correct phase relation of the seismic signal.

46778 (NP—4770405, pp 399-424) **Procedure for generating model seismograms according to the wave equation and to the ray principle.** Schneider, J. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

Model calculations can be employed in exploration seismology in order to assess the recording quality of field measurements, to control processing parameters or to check the evaluation of a measurement area. Since complete solutions of the elastic or acoustic wave equation can only be calculated by spending a great deal of time and material, various calculation programmes were developed which establish partial solutions. Within the research project, the following ones were considered: asymptotic approximation solutions for the elastic wave equation (ray procedure), three-dimensional image ray procedure, two-dimensional solutions of the acoustic wave equation in the areas of frequency, wave number and frequency path, as well as three-dimensional finite difference procedure in the path-time area.

46779 (NP—4770405, pp 425-436) **Improvement of vertical seismic profiles by controlling the exciting signal and development of a standard system for processing measurement results.** Koehler, K. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

Data quality in dependence of technical details of the measurement involved were studied on various results obtained with the measurement of seismic profiles in deep drillings. A data processing system was developed for processing the measurement data which contains the following essential processes: source-signal deconvolution, compensation of different amplitudes of the source signals, automatic alignment of the horizontal components of 3-component recording, special VSP deconvolutions, separation of the signals of different seismic waves, static and dynamic corrections of running times, analyses of running times and amplitudes, determination of the inclination of a reflector, processing of measurement results obtained with a constant receiver position at different source positions. Practical applicability and effectiveness of the processing system were tested on various practical measurement results and on synthetic seismic traces, too.

46780 (NP—4770405, pp 437-452) **Routine recording and interpretation of shear waves and converted waves.** Dohr, G. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

The basic characteristics of a field technology were demonstrated with the development of routine recording of shear waves. In the course of the investigations, its special advantage as a means of recording converted waves (PS waves) became apparent. The field technology employed does not require any additional energy source for generating S waves, but utilizes the energy of shots employed with routine measurements. In contrast to SS wave processing, conventional programmes of data processing are not applicable to PS waves. The results obtained sofar are to be further developed by means of novel and improved measurement data along with a discussion of essential issues concerning interpretation and processing of PS wave recordings. Simultaneously, there are activities undertaken for comparing synthetic seismograms with field recordings, for solving the problem of static corrections for S waves and for introducing SS or PS recordings to the programme packages of the inverse model procedure.

46781 (NP—4770405, pp 453-464) **Shear wave seismology.** Edelmann, H.A.K. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

The project of shear wave seismology aims at investigating various possible utilizations of shear waves and at showing pathways which are feasible in terms of technology and profitability with the prospection and development of deposits by means of shear waves. For this purpose, devices were developed for generating and recording shear waves. Shear wave mesurements in different areas were performed with these devices. The measurement results were processed in the data centre of Prakla-Seismos with the necessary programmes developed and extended accordingly.

46782 (NP—4770405, pp 465-472) **Direct detection of hydrocarbons with seismic procedures, applied to on-shore data.** Jurczyk, D. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

The aim of seismic prospection is to infer the presence of exploitable hydrocarbon deposits from characteristic features of seismic measurements at a high reliability. Structural processing of these measurement data provides high-resolution sections which will yield detailed information on the basement when intepreted geologically. Lithological processing tries to obtain information on the layers passed through following as reliable as possible an extraction of signal parameters (e.g. amplitude, frequency) according to their time change and lateral change, and to render them potentially applicable to an identification of rocks and rock fillings. This project aims at transferring to on-shore data the methods of the so-called "real amplitude processing" which has been fairly perfected with off-shore data processing. This implies that the effects of inhomogeneities of receiver and transmitter conditions ocurring on-shore have to be corrected and that the signal-to noise ratio has to be improved since it is worse, as a rule.

46783 (NP—4770405, pp 473-482) **Calculation of reflexion seismograms in laterally inhomogenic media.** Hubral, P. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

A computer programme (ASYMOD) was developed to such an extent that it allowed calculation of seismic rays for a pre-set three-dimensional model between a fixed short point and several receivers on the earth's surface. It is possible to pre-set up to ten layers with curved boundaries but with constant layer velocities. The layer boundaries are defined by bicubic spline functions. The shot point may be placed in any one layer. A general "code" for the ray course may be pre-set to calculate primary reflexions, multiple and conversion waves. Ray amplitudes and elementary seismograms can now be calculated by means of the principle of the asymptotic ray theory and by employing the wave front curvatures.

46784 (NP—4770405, pp 483-496) **Wave-theoretical treatment of reflection-seismological model problems (WELMOD).** Sattlegger, J. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

The WELMOD project aims at developing an inverse model procedure of reflexion seismology on the basis of the scalar wave equation. Input data constitute statically corrected traces prior to stacking and to applying the NMO correction, and an approximation model of the basement from interval velocities and horizons in deepness. Results constitute the field of reflectivities and the field of interval velocities. Model-seismological measurements and theoretical developments have been performed and a novel algorithm for calculating reflectivities has been implemented since the 1980 report of the state.

46785 (NP—4770405, pp 497-508) **Combined control signals for reflexion-seismological measurements according to the VIBROSEIS procedure.** Werner, H. 1984. (In German). NTIS (US Sales Only), PC A22/MF A01. File Number TI84770405.

In Second program energy research and energy technology. Vol. 1.

Concerning an improvement of the useful-signal-to-noise-signal ratio, generation and economic application of combined control signals constitute a remarkable possible application of computer-aided recording equipment in reflexion seismology, espec. in vibroseismology. The correlation noise specific to vibroseismology counts among the noise signals and can be suppressed effectively by means of appropriate control signal combinations. The studies focus on the development and testing of signal types serving this purpose. The paper reports on mainly two possible types of signal combination: a) combined control signal (combisweep sup((R))), and b) coded control signal. A description of measuring procedures employing both combined and coded control signals is followed by comments on testing and application. For matters of comparison, measurement results were used which were obtained by application of corresponding conventional control signals.

46786 **(SAND—84-0728) Signal characteristics of an underwater explosive acoustic telemetry system.** Calloway, T.M. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1984. Contract AC04-76DP00789. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016653.

Pressure pulses from small (<1 gm) explosive charges detonated between depths of 150 and 1200 m and detected by hydrophones submerged at a depth of 45 m are analyzed. Experimental data on peak pressures, time constants, and shock-wave/bubble-pulse intervals are summarized. The mass of each explosive is converted to its TNT energy-equivalent mass, which is used in fitting semiempirical scaling laws to the data. Equations are obtained for predicting the characteristics of the signal, given the range and depth of the explosive together with its TNT energy-equivalent mass. The parameter values that provide the best fit of the scaling laws to the experimental data are compared with those values applicable to larger explosives (>50 gm) detonated within 150 m of the surface. 20 references, 7 figures, 8 tables.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 58030045381, 45526, 45585, 45590, 45652, 45653, 45654, 46242, 46447

46787 **(DOE/SF/11509—T2) Thermal properties of soils and soils testing. Final report.** Waller, M.J.; Bligh, T.P. (EarthTech, Inc., Baltimore, MD (USA); Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Mechanical Engineering). Dec 1983. Contract AC03-80SF11509. 160p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE84015312.

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Thermal conductivity of dry moist soils and the difficulty of measuring thermal properties are discussed. The MIT thermal conductivity probe is presented along with a description of the design issues, validation experiments, errors, manufacturing and experimental procedures for using the probes in the laboratory and field (for continuous data gathering or for single or multiple measurements). A new method for producing the complete thermal conductivity versus moisture content curve, which eliminates most of the usual difficulties, is outlined. A new theory which can explain the complex variation of thermal conductivity of soil at different moisture contents for both frozen and unfrozen soils is presented. Empirical models, correlating soil thermal properties with standard soils analysis, for use by the field practitioner are offered along with an explanation of Time Domain Reflectometry techniques for measurement of in-situ soil moisture content. The report concludes with recommendation for future work. 134 references, 49 figures, 10 tables.

46788 **(NP—4770381) Investigation of the influences of the mining procedure on the kinematics of ground moving components during the concentrated mining of planely bedded deposit regions in the western Ruhr carbon.** Gilles, K.P. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 12 Mar 1982. 250p. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE84770381.

It is reported about the mining of planely bedded coal deposits on the kinematics of the ground moving components and the chronological distribution of the movements with concern of the mutual influencing of the mining height. The ground movements in the mines were precalculated according to the procedure of Ehrhardt/Sauer and compared with the observed final status of the ground movements. Extraordinarily large subsidence deficits with respect to the precalculation were found.

46789 **(UCID—20152) Mechanics of strata collapse above underground openings.** Thigpen, L. (Lawrence Livermore National Lab., CA (USA)). Aug 1984. Contract W-7405-ENG-48. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016580.

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This report examines the different subsidence profiles observed at the surface due to the collapse of underground cavities. This examination includes a synthesis and unification of results found in the literature on collapse mechanisms. The collapse mechanisms are discussed from the time of initial strata failure to the final subsidence profile in terms of material properties, in-situ stress state, strata failure mechanisms and bulking of the rubble falling into the opening. This study concludes that the type of failure mechanism, the properties of the strata above the opening, in particular its bulking characteristics and the stress state following the initiation of the opening (or cavity) are the most important problem areas in assessing the collapse of an underground opening. Finally, a listing of recommended studies on cavity collapse and subsidence is provided. 33 references, 12 figures, 3 tables.

46790 **Hybrid analytical/numerical computation of heat transfer in a gas driven fracture.** Griffiths, S.K.; Morrison, F.A.; Nilson, R.H. (Sandia National Laboratories, Albuquerque, NM). *American Society of Mechanical Engineers, [Paper]*; **83-WA/HT-35**: 9(Nov 1983). (CONF-831111—).

From ASME winter annual meeting; Boston, MA, USA (13 Nov 1983).

In gas-driven hydraulic fractures, as occur in rock blasting and underground nuclear testing, the high temperature gases (1,000 to 30,000 K) are radically cooled by heat transfer to the host material. This significantly reduces both the maximum extent and rate of fracture growth. The coupled processes of fluid flow, heat transfer, and rock deformation governing fracture growth are calculated here by a hybrid analytical/numerical procedure. The gas motion along a fracture of increasing length and aperture is described by a finite-difference form of the one-dimensional transport equations; fluid friction, advective heat transfer and heat loss to the walls of the fracture are considered. Lateral heat losses are evaluated in a quasi-analytical fashion, based on an integral method, that accounts for the convective film resistance between the fluid and fracture wall, as well as the conductive resistance within the surrounding medium. The calculations are performed on a difference grid that expands to maintain a fixed number of points uniformly distributed

along the fracture. The present numerical results agree, in appropriate limits, with known similarity solutions. Beyond this, new nonsimilar solutions for early-time fracture growth are presented.

5804 Geochemistry

REFER ALSO TO CITATION(S) 58040045585, 45586, 45587, 45589, 45591, 45596, 45614, 45656, 45657, 46608

46791 (LBL—15500, pp 65-126) **Geochemistry.** Sep 1983. NTIS, PC A13/MF A01. File Number TI84003916. Contract AC03-76SF00098.

In Earth Sciences Division annual report, 1982.

The geochemical research summaries focus upon the behavior of subsurface aqueous fluids at high temperatures and pressures. Concern about radioactive waste disposal has led to extensive modeling of the repository environment and to the analysis of ion migration and the chemical interaction of fluids flowing through rocks. Natural analogs of a radionuclide repository are reported, as well as the movement of meteoric water through old mill tailings dumps containing uranium. Such studies also involve maintaining a data base on aqueous radionuclide species and on the surface chemistry of minerals likely to be used in repository barriers. Investigations of the properties of silicate liquids are discussed. This effort includes making calorimetric measurements on solid silicate compounds and their corresponding liquids to contribute to the fundamental thermodynamic data of geologic materials.

46792 (LBL—15500, pp 127-205) **Reservoir engineering and hydrogeology.** Sep 1983. NTIS, PC A13/MF A01. File Number TI84003916. Contract AC03-76SF00098.

In Earth Sciences Division annual report, 1982.

Summaries are included which show advances in the following areas: fractured porous media, flow in single fractures or networks of fractures, hydrothermal flow, hydromechanical effects, hydrochemical processes, unsaturated-saturated systems, and multiphase multicomponent flows. The main thrust of these efforts is to understand the movement of mass and energy through rocks. This has involved treating fracture rock masses in which the flow phenomena within both the fractures and the matrix must be investigated. Studies also address the complex coupling between aspects of thermal, hydraulic, and mechanical processes associated with a nuclear waste repository in a fractured rock medium. In all these projects, both numerical modeling and simulation, as well as field studies, were employed. In the theoretical area, a basic understanding of multiphase flow, nonisothermal unsaturated behavior, and new numerical methods have been developed. The field work has involved reservoir testing, data analysis, and case histories at a number of geothermal projects.

5805 Oceanography

REFER ALSO TO CITATION(S) 58050045457

46793 **Application of remote wind-forced coastal trapped wave theory to the Oregon and Washington coasts.** Battisti, D.S.; Hickey, B.M. (University of Washington, Seattle, Washington 98195). *Journal of Physical Oceanography;* **14**: No. 5, 887-935(May 1984). Contract AT06-76EV71025.

The theory of coastal trapped waves generated by remote wind forcing (Clarke) is used to calculate coastal subsurface pressure (SSP) and longshore velocity along the Oregon and Washington coasts for three two-month periods; summer of 1972, summer of 1978 and winter of 1977. The response in SSP and longshore velocity is assumed to be dominated by the mode one wave. In every case, coherence squared between observed and modeled SSP is significant at the 95% level over the entire low frequency band (< or =0.2 cpd) with an average phase difference less than +- 3°. Greater than 80% of the variance in coastal SSP is accounted for by the mode one coastal trapped wave (CTW). The SSP response off Washington and Oregon during summer is primarily (~35% of the variance) a result of wind forcing between San Francisco and Cape Mendocino, California. Wind stress in this region during summer is significantly larger than that off Oregon and Washington at low frequencies so that the CTW generated off California propagates northward with only minimal input from the local wind field. The local contribution to SSP off Oregon and Washington during summer is relatively small (<15%). The response during winter, on the other hand, is dominated by local wind stress, local winds being much more energetic than those to the south. Comparison between modeled and observed longshore velocity shows that at low frequencies a significant portion of the variance in longshore velocity on the Pacific Northwest Shelf is also accounted for by the mode one wind forced CTW.

46794 **Low-frequency current and temperature variability from Gulf Stream frontal eddies and atmospheric forcing along the southeast US outer continental shelf.** Lee, T.N.; Atkinson, L.P. (Univ. of Miami, FL). *Journal of Geophysical Research;* **88**: No. C8, 4541-4567(30 May 1983).

Low-frequency current and temperature time series from the outer shelf between Cape Canaveral, Florida, and Cape Romain, South Carolina, are compared with shipboard hydrographic data, satellite VHRR, coastal and buoy winds, and coastal sea level during the period from February to June 1980. Low-frequency current and temperature variability along the shelf break was primarily produced by cyclonic, cold core Gulf Stream frontal eddies. These disturbances traveled to the north at speeds of 50 to 70 cm s^{-1} with periods of 5 to 9 days throughout the experiment and produced cold cyclonic perturbations of the northward mean flow and temperature fields over an along-shelf coherence scale of 100 km. Frontal eddies appear to be an important mechanism in the observed eastward transport of northward momentum and heat along the shelf edge. They also appear to play a key role in the transfer of eddy kinetic and potential energy back to the mean flow, which suggests an upstream formation region and shear-induced dissipation. Upwelling velocities of about 10^{-2} cm s^{-2} in the cold core provide the major source of new nutrients to the outer shelf. Subtidal flow variability at the 40-m isobath was a mixed response to Gulf Stream and wind forcing. Baratropic along-shelf current oscillations were coherent with the local winds and coastal sea level at periods of 3-4 and 10-12 days over along-shelf scales of 400 km with small phase lags, suggesting a nearly simultaneous frictional equilibrium response to coherent wind-induced sea level slopes. 24 figures, 2 tables.

46795 **Real-time telemetry system for hydrographic and meteorological data collection in the South Atlantic Bight.** Schwing, F.B.; Blanton, J.O.; Lamhut, L.; Knight, L.H.; Baker, C.V. (Skidaway Inst. of Oceanography, Savannah, GA). pp 44-50 of 1983 IEEE proceedings of the third working symposium on oceanographic data systems. New York, NY; Institute of Electrical and Electronics Engineers (1983). Contract AS09-80EV10331.

Real-time hydrographic and meteorological data are telemetered from a fixed platform 20 km offshore to a micro-computer system at Skidaway Institute of Oceanography. A suite of sensors tie into the telemetry system. Meteorological parameters sampled include winds, air temperature, and barometric pressure. Ocean currents, water temperature, conductivity, and subsurface pressure are measured below the platform. The telemetry system transmits at a VHF frequency and has the capability to process and transmit voltage values for as many as 32 channels each second. The data stream is automatically sampled on the hour for 150 seconds, and statistics for each parameter are stored on disk and tape. Software is available to perform data editing and reduction and preliminary analysis. The system can be accessed by other agencies, including the National Weather Service. 9 references, 6 figures, 1 table.

64 PHYSICS. I.

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 64010047016

46796 (LA-UR—84-2517) Supernova envelope shock origin of cosmic rays: a review. Colgate, S.A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 36p. (CONF-8406167—4). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016479.

From 25. plenary session of COSPAR; Graz, Austria (25 Jun 1984).

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The hydrodynamic shock origin of cosmic rays in the envelope of a Type I presupernova star is reviewed. The possibility of accelerating ultrahigh energy particles to $\geqq 10^{18}$ eV is unique to the shock mechanism and currently no other suggested galactic or extragalactic site is likely. In this paper a review of the work leading to a renewed commitment to the origin of cosmic rays in the shock ejected envelope of supernova is given. The degree to which this interpretation applies to the origin of all cosmic rays is certainly uncertain and does not exclude the possibility of a fraction of the lower energy cosmic rays being accelerated in collisionless plasma shocks in the interstellar medium. 45 references, 3 figures.

46797 (N—84-12663) Scale lengths in quasi-parallel shocks. Scudder, J.D.; Burlaga, L.F.; Greenstadt, E.W. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Oct 1983. 15p. (NASA-TM—85109). NTIS, PC A02/MF A01.

Examples of an interplanetary and the bow shock illustrate the small relative size of the electrostatic layer relative to the scale of the magnetic fluctuations in quasi-parallel shocks. While both examples are supercritical, the interplanetary example is marginally so, showing a thickness in absolute and convected ion larmor radii units that is thicker (approximately 13 U/omega sub ci) than at the bow shock (approximately omega sub ci). The fluid speed changes abruptly in the quasi-parallel shock on this shorter scale. The increase in electron and ion random energies also is clearly seen on this shorter scale. In the interplanetary example the scale of the electric layer is certainly less than 1/60th that of the up or downstreams magnetic fluctuations. The thickness of the earth's bow shock deceleration layer is dramatically narrower than any domain of upstream waves as controlled by reflected, intermediate, or diffuse ions.

46798 (N—84-13044) Spectral analysis of magnetohydrodynamic fluctuations near interplanetary schocks. Vinas, A.F.; Goldstein, M.L.; Acuna, M.H. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Nov 1983. 43p. (NASA-TM—85119). NTIS, PC A03/MF A01.

Evidence for two types of relatively large amplitude MHD waves upstream and downstream of quasi-parallel forward and reverse interplanetary shocks is presented. The first mode is an Alfven wave with frequencies (in the spacecraft frame) in the range of 0.025 to 0.07 Hz. This is a left-hand polarized mode and propagates within a few degrees of the ambient magnetic field. The second is a fast MHD mode with frequencies in the range of 0.025 to 0.17 Hz, right-hand polarization and propagating along the magnetic field. These waves are detected principally in association with quasi-parallel shock. The Alfven waves are found to have plasma rest frame frequencies in the range of 1.1 to 6.3 mHz with wavelengths in the order of 4.8 x 10 to the 8th power to 2.7 x 10 to the 9th power cm. Similarly, the fast MHD modes have rest frame frequencies in the range 1.6 to 26 mHz with typical wavelengths about 2.19 x 10 to the 8th power cm. The magnetic field power spectrum in the vicinity of these interplanetary shocks is much steeper than f to the -s/3 at high frequencies. The observed spectra have a high frequency dependence of f to the -2/5 to f to the -4.

46799 (N—84-13045) Radial variations of large-scale magnetohydrodynamic fluctuations in the solar wind. Burlaga, L.F.; Goldstein, M.L. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Nov 1983. 19p. (NASA-TM—85116). NTIS, PC A02/MF A01.

Two time periods are studied for which comprehensive data coverage is available at both 1 AU using IMP-8 and ISEE-3 and beyond using Voyager 1. One of these periods is characterized by the predominance of corotating stream interactions. Relatively small scale transient flows characterize the second period. The evolution of these flows with heliocentric distance is studied using power spectral techniques. The evolution of the transient dominated period is consistent with the hypothesis of turbulent evolution including an inverse cascade of large scales. The evolution of the corotating period is consistent with the entrainment of slow streams by faster streams in a deterministic model.

46800 (N—84-13046) Boundary layers in cataclysmic variables: the HEAO-1 X-ray constraints. Jensen, K.A. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Oct 1983. 41p. (NASA-TM—85112). NTIS, PC A03/MF A01.

The predictions of the boundary layer model for the X-ray emission from novae are summarized. A discrepancy between observations and theory in the X-ray observations is found. Constraints on the nature of the boundary layers in novae, based on the lack of detections of novae in the HEAO-1 soft X-ray survey are provided. Temperature and column densities for optically thick boundary layers in novae are estimated.

46801 (N—84-13064) Relative abundances of Sn, Te, Xe, Ba and Ce. Krombel, K.E. (California Inst. of Tech., Pasadena (USA)). 1983. 155p. (NASA-CR—174599). NTIS, PC A08/MF A01.

Elements with even atomic number (Z) in the interval 50 < or = Z < or = 58 were resolved in the cosmic radiation using the Heavy Nuclei Experiment on the HEAO-3 satellite. Their relative abundances were compared with the results expected from pure r-process material, pure s-process material, and solar system material, both with and without a modification due to possible first ionization potential effects. Such effects may be the result of the preferential acceleration, and hence enhancement in the cosmic rays, of those elements having low first ionization potentials. Measurements were found to be inconsistent with pure r-process material at the greater than 98% confidence level whether or not the first ionization potential adjustments are made.

46802 (N—84-13065) Interpretation of 3He variations in the solar wind. Coplan, M.A.; Ogilvie, K.W.; Geiss, J. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Jun 1983. 45p. (NASA-TM—85049). NTIS, PC A03/MF A01.

The ion composition instrument (ICI) on ISEE-3 observed the isotopes of helium of mass 3 and 4 in the solar wind almost continuously between August 1978 and July 1982. This period included the increase towards the maximum of solar activity cycle 21, the maximum period, and the beginning of the descent towards solar minimum. Observations were made when the solar wind speed was between 300 and 620 km/s. For part of the period evidence for regular interplanetary magnetic sector structure was clear and a number of 3He flares occurred during this time.

46803 (N—84-13067) Solar Wind Five. Neugebauer, M. (Jet Propulsion Lab., Pasadena, CA (USA)). Nov 1983. 688p. (NASA-CP—2280). NTIS, PC A99/MF A01.

Topics of discussion were: solar corona, MHD waves and turbulence, acceleration of the solar wind, stellar coronae and winds, long term variations, energetic particles, plasma distribution functions and waves, spatial dependences, and minor ions. For individual titles, see N84-13068 through N84-13126.

46804 (N—84-13068) Coronal heating by waves. Hollweg, J.V. (New Hampshire Univ., Durham (USA)). Nov 1983. 17p. NTIS, PC A99/MF A01.

Alfven waves or Alfvenic surface waves carry enough energy into the corona to provide the coronal energy requirements. Coronal loop resonances are an appealing means by which large energy fluxes enter active region loops. The wave dissipation mechanism still needs to be elucidated, but a Kolmogoroff turbulent cascade is fully consistent with the heating requirements in coronal holes and active region loops.

46805 **(N—84-13069) Direct coronal heating from dissipation of magnetic field.** Parker, E.N. (Chicago Univ., IL (USA)). Nov 1983. 9p. NTIS, PC A99/MF A01.

The visible corona of the Sun appears to be heated by direct dissipation of magnetic fields. The magnetic fields in the visible corona are tied at both ends to the photosphere where the active convection continually rotates and shuffles the footpoints in a random pattern. The twisting and wrapping of flux tubes about each other produce magnetic neutral sheets in a state of dynamical nonequilibrium such that the current sheets become increasingly concentrated with the passage of time. Dissipation of the high current densities takes place regardless of the high electrical conductivity of the fluid. The convection on the feet of the lines of force at the surface of the Sun goes directly (within a matter of 10 to 20 hours) into heat in the corona. The rate of doing work seems adequate to supply the necessary 10 to the 7th power ergs/square cm. sec for the active corona.

46806 **(N—84-13070) HRTS observations of the fine structure and dynamics of the solar chromosphere and transition zone.** Dere, K.P. (Hulbert (E.O.) Center for Space Research, Washington, DC (USA)). Nov 1983. 11p. NTIS, PC A99/MF A01.

Arc-second UV observations of the Sun by the NRL High Resolution Telescope and Spectrograph (HRTS) have led to the discovery of dynamic fine structures such as 400 km/s coronal jets and chromospheric jets (spicules) and have provided new information about the structure and dynamics of the transition zone. These observations are reviewed and their relevance to the origin of the solar wind is discussed.

46807 **(N—84-13071) Spectroscopic measurements of solar wind generation.** Kohl, J.L.; Withbroe, G.L.; Zapata, C.A.; Noci, G. (Harvard-Smithsonian Center for Astrophysics, Cambridge, MA (USA)). Nov 1983. 13p. NTIS, PC A99/MF A01.

Spectroscopically observable quantities are described which are sensitive to the primary plasma parameters of the solar wind's source region. The method is discussed in which those observable quantities are used as constraints in the construction of empirical models of various coronal structures. Simulated observations are used to examine the fractional contributions to observed spectral intensities from coronal structures of interest which co-exist with other coronal structures along simulated lines-of-sight. The sensitivity of spectroscopic observables to the physical parameters within each of those structures is discussed.

46808 **(N—84-13072) Coronal transients in FE XIV 5303A: first two-dimensional photoelectric ground-based observations.** Altrock, R.C.; Demastus, H.L. (Sacramento Peak Observatory, Sunspot, NM (USA)). Nov 1983. 5p. NTIS, PC A99/MF A01.

An observational program was undertaken at Sacramento Peak Observatory to photoelectrically detect coronal transients. Continuous observations are made in the Fe XIV 5303A green line, utilizing the 40 cm coronagraph and the Photoelectric Coronal Photometer. Scans at three heights above the limb are combined to form a low resolution picture of the greenline corona every 20 to 30 minutes. Difference pictures, relative to an initial scan, are generated to search for sudden changes in the corona. The first few days of operation of this program have yielded three low-lying events (1.55 solar radii) following minor chromospheric activity (a surge and eruptive prominences), which propagated up through the corona with velocities on the order of 100 km/s.

46809 **(N—84-13073) Magnetohydrodynamic turbulence in the solar wind.** Matthaeus, W.H.; Goldstein, M.L. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Nov 1983. 8p. NTIS, PC A99/MF A01.

Recent work in describing the solar wind as an MHD turbulent fluid has shown that the magnetic fluctuations are adequately described as time stationary and to some extent as spatially homogeneous. Spectra of the three rugged invariants of incompressible MHD are the principal quantities used to characterize the velocity and magnetic field fluctuations. Unresolved issues concerning the existence of actively developing turbulence are discussed.

46810 **(N—84-13074) Observations of hydromagnetic turbulence in the solar wind.** Denskat, K.U.; Neubauer, F.M. (Technische Univ. Braunschweig (Germany, F.R.)). Nov 1983. 11p. NTIS, PC A99/MF A01.

MHD turbulence is studied by anayzing magnetic field and plasma observations from Helios-1 and -2 at minimum solar activity. The steady conditions in the plasma flows and the magnetic field sector structure in 1975/1976 facilitate an investigation of the radial evolution of the turbulence from 0.29 to 1AU. In high speed streams the fluctuations in the solar wind velocity v and the magnetic field b are highly correlated (the correction coefficient almost being one), which indicates that the turbulence is mainly Alfvenic in high speed plasma. While some general fluctuation properties remain essentially unchanged from 0.29 to 1AU, power spectral analysis reveals a different frequency composition of the Alfvenic turbulence at different heliocentric distances. At 0.3AU much more 'high' frequency fluctuations contribute to the total power in the magnetic field and velocity fluctuations than at 1AU. The contributions of field magnitude fluctuations are found to be distance and frequency dependent. Magnetic field spectra with an extended frequency range up to 470Hz show certain frequency bands, where the steepness of the spectra is independent of the helicocentric distance.

46811 **(N—84-13075) Alfven solitons in the solar wind.** Ovenden, C.; Schwartz, S.J. (Queen Mary Coll., London (UK)). Nov 1983. 5p. NTIS, PC A99/MF A01.

A nonlinear Alfven soliton solution of the MHD equations is presented. This solution represents the final state of modulationally unstable Alfven waves. A model of the expected turbulent spectrum due to a collection of such solitons is briefly described.

46812 **(N—84-13076) Interplanetary Alfvenic fluctuations: a statistical study of the directional variations of the magnetic field.** Bavassano, B.; Mariani, F. (Consiglio Nazionale delle Richerche, Frascati (Italy)). Nov 1983. 5p. NTIS, PC A99/MF A01.

Magnetic field data from HELIOS 1 and 2 are used to test a stochastic model for Alfvenic fluctuations recently proposed. A reasonable matching between observations and predictions is found. A rough estimate of the correlation length of the observed fluctuations is inferred.

46813 **(N—84-13077) Theory of hydromagnetic turbulence.** Montgomery, D. (College of William and Mary, Williamsburg, VA (USA)). Nov 1983. 23p. NTIS, PC A99/MF A01.

The present state of MHD turbulence theory as a possible solar wind research tool is surveyed. The theory is statistical, and does not make statements about individual events. The ensembles considered typically have individual realizations which differ qualitatively, unlike equilibrium statistical mechanics. Most of the theory deals with highly symmetric situations. Most of these symmetries have yet to be tested in the solar wind. The applicability of MHD itself to solar wind parameters is highly questionable; yet it has no competitors, as a potentially comprehensive dynamical description. The purpose of solar wind research require sharper articulation. If they are to understand radial turbulent plasma flows from spheres, laboratory experiments and numerical solution of equations of motion may be cheap alternative to spacecraft. If real life information is demanded, multiple spacecraft with variable separation may be necessary to go further. The principal emphasis in the theory so

far has been on spectral behavior for spatial covariances in wave number space. There is no respectable theory of these for highly anisotropic situations. A rather slow development of theory acts as a brake on justifiable measurement, at this point.

46814 (N—84-13078) Observational constraints on solar wind acceleration mechanisms. Neugebauer, M. (Jet Propulsion Lab., Pasadena, CA (USA)). Nov 1983. 11p. NTIS, PC A99/MF A01.

A complete theoretical understanding of the acceleration of the solar wind must account for at least three types of solar wind flow: high-speed streams associated with coronal holes, low-speed boundary layer flows associated with sector boundaries, and both high- and low-speed flows associated with impulsive ejections from the Sun. The properties of each type of flow are summarized.

46815 (N—84-13079) Role of thermal conduction in the acceleration of the solar wind. Olbert, S. (Massachusetts Inst. of Tech., Cambridge (USA)). Nov 1983. 13p. NTIS, PC A99/MF A01.

The thermal and suprathermal processes involving solar wind electrons are discussed from a theoretical point of view. A model for the electron distribution function, f(e), based on the solutions of the Boltzmann equation in Krook's approximation is outlined: the angular and energy dependences for various distances from the Sun between the coronal base and the Earth are presented with the express purpose of obtaining the radial profile of the heat flux generated by the suprathermals. The basic fluid-dynamical equations for the solar wind plasma as a whole along any given magnetic field line are solved. Results are in good agreement with observations. The predicted density and temperature profiles for positive ions exhibit the characteristics of recent measurements, both in the corona (above the coronal holes) and between 0.3 and 1 A.U. (the Helios region). It is concluded that the suprathermal electrons play an important role in the formation and the dynamics of the solar wind.

46816 (N—84-13080) Collapse of the local, Spitzer-Haerm formulation and a global-local generalization for heat flow in an inhomogeneous, fully ionized plasma. Scudder, J.D.; Olbert, S. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Nov 1983. 19p. NTIS, PC A99/MF A01.

The breakdown of the classical (CBES) field aligned transport relations for electrons in an inhomogeneous, fully ionized plasma as a mathematical issue of radius of convergence is addressed. The finite Knudsen number conditions when CBES results are accurate is presented and a global-local (GL) way to describe the results of Coulomb physics moderated conduction that is more nearly appropriate for astrophysical plasmas are defined. This paper shows the relationship to and points of departure of the present work from the CBES approach. The CBES heat law in current use is shown to be an especially restrictive special case of the new, more general GL result. A preliminary evaluation of the dimensionless heat function, using analytic formulas, shows that the dimensionless heat function profiles versus density of the type necessary for a conduction supported high speed solar wind appear possible.

46817 (N—84-13081) Magnetohydrodynamic modeling of coronal structure and expansion. Suess, S.T. (National Oceanic and Atmospheric Administration, Boulder, CO (USA)). Nov 1983. 15p. NTIS, PC A99/MF A01.

The presence of a magnetic field in the corona adds structure to the solar wind and almost certainly plays an important role in the energetics of the flow. Analytical and numerical modeling of gas-magnetic field interactions as used to compute steady, global flow are discussed. The approach used in, and results from a recent global model (Steinolfson, Suess and Wu, 1982) are discussed. Ideas on the most effective ways to improve the physical content and numerical efficiency of these models are outlined. Solutions of the MHD equations are discussed only in order to find steady-state flows, even though this often entails solving time-dependent equations.

46818 (N—84-13082) Observational evidence for solar wind acceleration at the base of coronal holes. Rottman, G.J.; Orrall, F.Q. (Colorado Univ., Boulder (USA)). Nov 1983. 11p. NTIS, PC A99/MF A01.

An EUV spectrometer with a microchannel plate detector was developed to measure Doppler shifts of coronal and transition region lines. The results of three sounding rocket fights of this instrument indicate that EUV resonance emission lines are systematically shifted toward shorter wavelength within coronal holes. This blue-shift signature, first identified within compact low latitude holes, was also observed in a well developed polar coronal hole. The maximum measured shift within these coronal holes corresponds to a velocity relative to the remaining solar disc of 12 km/s in lambda 625 Mg X T to the approximately 10 to the 6.15 K power and 7 km /s/ in lambda 629 OV (T to the approximately 10 to the 5.4 K power). The existing data indicate that these blue-shifts are a common (and possibly universal) signature of coronal holes. These data provide important information on the acceleration of coronal plasma in open magnetic field regions, although the interpretation of observed Doppler shifts to derive a systematic mass flux is to some extent model dependent. A straightforward hypothesis is that the blueshift signature is a direct manifestation of the high speed solar wind deep within the transition region and inner corona.

46819 (N—84-13083) Multiple transonic solutions and a new class of shock transitions in solar and stellar winds. Habbal, S.R.; Tsinganos, K.; Rosner, R. (Harvard-Smithsonian Center for Astrophysics, Cambridge, MA (USA)). Nov 1983. 7p. NTIS, PC A99/MF A01.

The steady isothermal solar wind equations are shown to admit, under certain circumstances, mutliple transonic solutions when, for example, momentum deposition gives rise to muliple critical points in the flow. These multiple solutions consist of a continuous solution and solutions which involve shock transitions between critical solutions. The ambiguity arising from the multiplicity of the solutions can be resolved by following the time evolution of a wind profile with one critical point. Results of the numerical integration of the time-dependent equations with momentum addition show that each of these multiple solutions is physically accessible and depends on the rate of change of momentum deposition. These results suggest that standing shocks are likely to be present in the inner solar wind flow.

46820 (N—84-13084) Observation of winds in cool stars. Dupree, A.K. (Harvard-Smithsonian Center for Astrophysics, Cambridge, MA (USA)). Nov 1983. 11p. NTIS, PC A99/MF A01.

Sufficient observational material - ultraviolet spectroscopic measures, quantitative optical spectroscopy, and X-ray photometry exists to enable discernment of the presence and character of mass loss in cool stars and to establish meaningful constraints on theoretical models. Two determinants of atmospheric wind structure - temperature and gravity - may suffice in a most superficial way to define the wind and atmospheric structure in a star. However more extensive observations demonstrate the importance of magnetic surface activity and its particular geometrical configuration. Successive observations of an active binary system and a supergiant star reveal that magnetic activity and perhaps mass loss occur on restricted regions of a stellar surface and that long lived structures are present in a wind.

46821 (N—84-13085) Theory of winds in late-type evolved and pre-main-sequence stars. Macgregor, K.B. (National Center for Atmospheric Research, Boulder, CO (USA)). Nov 1983. 21p. NTIS, PC A99/MF A01.

Recent observational results confirm that many of the physical processes which are known to occur in the Sun also occur among late-type stars in general. One such process is the continuous loss of mass from a star in the form of a wind. There now exists an abundance of either direct or circumstantial evidence which suggests that most (if not all) stars in the cool portion of the HR diagram possess winds. An attempt is made to assess the current state of theoretical understanding of mass loss from two distinctly different classes of late-type stars: the post-main-sequence giant/super-

giant stars and the pre-main-sequence T Tauri stars. Toward this end, the observationally inferred properties of the wind associated with each of the two stellar classes under consideration are summarized and compared against the predictions of existing theoretical models. Although considerable progress has been made in attempting to identify the mechanisms responsible for mass loss from cool stars, many fundamental problems remain to be solved.

46822 **(N—84-13086) Winds and coronae of early-type stars.** Cassinelli, J.P. (Wisconsin Univ., Madison (USA)). Nov 1983. 15p. NTIS, PC A99/MF A01.

The properties of the winds of hot stars as derived from radio, ultraviolet and X-ray observations is presented. Special focus is given to observations that test line driven wind theory. In this theory the wind properties are determined by the stellar effective temperature and surface gravity, but not parameters that specify the mechanical or wave fluxes from the star. Alternate explanations of the X-ray emission from the early-type stars are discussed. Evidence is given for the presence of coronal zones at the base of the stellar winds.

46823 **(N—84-13087) Stellar winds driven by multi-line scattering.** Friend, D.B. (National Center for Atmospheric Research, Boulder, CO (USA)). Nov 1983. 7p. NTIS, PC A99/MF A01.

This paper presents a model of a radiation-driven stellar wind with overlapping spectral lines. It is based on the Castor, Abbott, and Klein (CAK) theory. The presence of overlapping lines allows a photon to be scattered many times in different lines. The properties of the wind at any point depend on the wavelength-averaged intensity, which in turn depends on the structure of the wind. A self-consistent wind model is found. The mass loss rate does not saturate as line overlap becomes more pronounced, but continues to increase. The terminal velocity is much larger than in the CAK model, while the velocity law is shallower. This model might help explain the massive winds from Wolf-Rayet stars.

46824 **(N—84-13088) Formation of standing shocks in stellar winds and related astrophysical flows.** Tsinganos, K.; Habbal, S.R.; Rosner, R. (Harvard-Smithsonian Center for Astrophysics, Cambridge, MA (USA)). Nov 1983. 5p. NTIS, PC A99/MF A01.

Stellar winds and other analogous astrophysical flows can be described, to lowest order, by the familiar one dimensional hydrodynamic equations which, being nonlinear, admit in some instances discontinuous as well as continuous transonic solutions for identical inner boundary conditions. The characteristics of the time dependent differential equations of motion are described to show how a perturbation changes profile in time and, under well defined conditions, develops into a stationary shock discontinuity. The formation of standing shocks in wind type astrophysical flows depends on the fulfillment of appropriate necessary conditions, which are determined by the conservation of mass, momentum and energy across the discontinuity, and certain sufficient conditions, which are determined by the flow's history.

46825 **(N—84-13089) Solar cycle variations of the solar wind.** Crooker, N.U. (California Univ., Los Angeles (USA)). Nov 1983. 11p. NTIS, PC A99/MF A01.

Throughout the course of the past one and a half solar cycles, solar wind parameters measured near the ecliptic plane at 1 AU varied in the following way: speed and proton temperature have maxima during the declining phase and minima at solar minimum and are approximately anti-correlated with number density and electron temperature, while magnetic field magnitude and relative abundance of helium roughly follow the sunspot cycle. These variations are described in terms of the solar cycle variations of coronal holes, streamers, and transients. The solar wind signatures of the three features are discussed in turn, with special emphasis on the signature of transients, which is still in the process of being defined. It is proposed that magnetic clouds be identified with helium abundance enhancements and that they form the head of a transient surrounded by streamer like plasma, with an optional shock front. It is stressed that relative values of a parameter through a solar cycle should be compared beginning with the declining phase, especially in the case of magnetic field magnitude.

46826 **(N—84-13090) Solar cycle evolution of the solar wind in three dimensions.** Rickett, B.J.; Coles, W.A. (California Univ., San Diego, La Jolla (USA)). Nov 1983. 7p. NTIS, PC A99/MF A01.

Measurements of the solar wind speed both in and out of the ecliptic are presented for 1971-82. The speed estimates, which were made with the interplanetary scintillation system at UC San Diego, have been compared to in situ for large, slowly evolving structures, and thus such structures can be studied up to 60 degrees north and south heliographic latitude. Annual average wind speeds are presented versus latitude for an entire solar cycle. Fast wind streams from the poles persisted through declining and low solar activity, but were closed off during four years of high activity. This evolution follows that of the polar coronal holes, as displayed by comparing averaged speed and coronal density over latitude and longitude. The most recent data (1982) show the reestablishment of large tilted polar holes and associated fast streams. Coronal magnetic field data show that the neutral sheet is confined to low latitudes at solar minimum and extends to high latitudes at solar maximum thus the slow solar wind comes from the same latitude range as that of the neutral sheet.

46827 **(N—84-13091) Solar cycle variations in the interplanetary magnetic field.** Slavin, J.A.; Smith, E.J. (Jet Propulsion Lab., Pasadena, CA (USA)). Nov 1983. 9p. NTIS, PC A99/MF A01.

ISEE 3 interplanetary magnetic field measurements have been used to extend the NSSDC hourly averaged IMF composite data set through mid-1982. Most of sunspot cycle 20 (start:1964) and the first half of cycle 21 (start:1976) are now covered. The average magnitude of the field was relatively constant over cycle 20 with approx. 5-10% decreases in 1969 and 1971, when the Sun's polar regions changed polarity, and a 20% decrease in 1975-6 around solar minimum. Since the start of the new cycle, the total field strength has risen with the mean for the first third of 1982 being about 40% greater than the cycle 20 average. As during the previous cycle, an approx. 10% drop in IMF magnitude accompanied the 1980 reversal of the solar magnetic field. While the interplanetary magnetic field is clearly stronger during the present solar cycle, another 5-7 years of observations will be needed to determine if cycle 21 exhibits the same modest variations as the last cycle. Accordingly, it appears at this time that intercycle changes in IMF magnitude may be much larger than the intracycle variations.

46828 **(N—84-13092) Solar wind variations in the 60-100 year period range: a review.** Feynman, J. (Boston Coll., Chestnut Hill, MA (USA)). Nov 1983. 13p. NTIS, PC A99/MF A01.

The evidence for and against the reality of a solar wind variation in the period range of 60-100 years is reexamined. Six data sets are reviewed sunspot numbers, geomagnetic variations, two auroral data sets and two (14)C data sets. These data are proxies for several different aspects of the solar wind and the presence or absence of 60-100 year cyclic behavior in a particular data set does not necessarily imply the presence or absence of this variation in other sets. It was concluded that two different analyses of proxy data for a particular characteristic of the heliospheric solar wind yielded conflicting results. This conflict can be resolved only by future research. It is also definitely confirmed that proxy data for the solar wind in the ecliptic at 1 A.U. undergo a periodic variation with a period of approximately 87 years. The average amplitude and phase of this variation as seen in eleven cycles of proxy data are presented.

46829 **(N—84-13093) Periodicities in the occurrence of aurora as indicators of solar variability.** Nian-Zu, D.; Mei-Dong, C. (Academia Sinica, Beijing (China)). Nov 1983. 4p. NTIS, PC A99/MF A01.

A compilation of records of the aurora observed in China from the Time of the Legends (2000 - 3000 B.C.) to the mid-18th century has been used to infer the frequencies and strengths of solar activity prior to modern times. A merging of this analysis with auroral and solar activity patterns during the last 200 years provides basically continuous information about solar activity during the last

2000 years. The results show periodicities in solar activity that contain average components with a long period (approx. 412 years), three middle periods (approx. 38 years, approx. 77 years, and approx. 130 years), and the well known short period (approx. 11 years).

46830 **(N—84-13094) Radial evolution of ion distribution functions.** Marsch, E. (Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (Germany, F.R.)). Nov 1983. 13p. NTIS, PC A99/MF A01.

A survey of solar wind ion velocity distributions and derived parameters (temperature, ion differential speed, heat flux, adiabatic invariants) is presented with emphasis on the heliocentric distance range between 0.3 and 1 AU traversed by the Helios solar probe. The radial evolution of nonthermal features are discussed which are observed to be most pronounced at perihelion. Within the framework of quasilinear plasma theory, wave particle interactions that may shape the ion distributions are considered. Some results of a self consistent model calculation are presented accounting for ion acceleration and heating by resonant momentum and energy exchange with ion cyclotron and magnetosonic waves propagating away from the Sun along the interplanetary magnetic field. Another tentative explanation for the occurrence of large perpendicular proton temperatures is offered in terms of heating by Landau damping of lower hybrid waves.

46831 **(N—84-13095) Electrostatic waves and anomalous transport in the solar wind.** Dum, C.T. (Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany, F.R.)). Nov 1983. 8p. NTIS, PC A99/MF A01.

In situ measurements of fluctuation spectra and particle distribution functions have now been carried out throughout interplanetary space. The link between these observations is established by theories of wave particle interaction. Linear instability analysis for the actual nonMaxwellian particle distribution functions and an examination of the velocity dependence of microscopic diffusion coefficients form the basis of such an investigation. It is described in more detail for the short wavelength, ion acoustic like turbulence which is found by linear instability analysis to correspond to the observed electrostatic fluctuations. Of the transport processes associated with these fluctuations, electron heat conduction and electron ion energy transfer are of particular importance for macroscopic solar wind expansion. These effects are studied with the aid of an anomalous transport theory. This theory (Dum, 1978 a,b) is based on the dominance of elastic scattering of electrons by fluctuations, similar to (enhanced) electron ion collisions. It has a much wider range of applicability than classical transport theory, which assumes dominance of Coulomb collisions for elastic and inelastic scattering.

46832 **(N—84-14082) Soft X-ray spectral observations of quasars and high X-ray luminosity Seyfert galaxies.** Petre, R.; Mushotzky, R.F.; Krolik, J.H.; Holt, S.S. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Nov 1983. 53p. (NASA-TM—85118). NTIS, PC A04/MF A01.

Results of the analysis of 28 Einstein SSS observations of 15 high X-ray luminosity (L(x) 10 to the 435 power erg/s) quasars and Seyfert type 1 nuclei are presented. The 0.75-4.5 keV spectra are in general well fit by a simple model consisting of a power law plus absorption by cold gas. The averager spectral index alpha is 0.66 + or - .36, consistent with alpha for the spectrum of these objects above 2 keV. In all but one case, no evidence was found for intrinsic absorption, with an upper limit of 2 x 10 to the 21st power/sq cm. Neither was evidence found for partial covering of the active nucleus by dense, cold matter (N(H) 10 to the 22nd power/sq cm the average upper limit on the partial covering fraction is 0.5. There is no obvious correlation between spectral index and 0175-4.5 keV X-ray luminosity (which ranges from 3 x 10 to the 43rd to 47th powers erg/s or with other source properties. The lack of intrinsic X-ray absorption allows us to place constraints on the density and temperature of the broad-line emission region, and narrow line emission region, and the intergalactic medium.

46833 **(N—8422783) Central burst of simultaneously rotating and gravitating body.** Golubyatnikov, A.N.; Chilachava, T.I. (Joint Publications Research Service, Arlington, VA (USA)). Apr 1984. 1p. NTIS, PC A03/MF A01.

The astrophysical problem of bursts in simultaneously rotating and gravitating celestial bodies is treated as an axisymmetric one for a homogeneous ellipsoid bursting at the center. It is formulated in a system of spherical coordinates with the sought distributions of pressure and gravitational potential appropriately stipulated. The corresponding equations of steady axisymmetric adiabatic motion of a gas during the initial stage, before the shock wave reaches the surface, are formulated in Lagrange variables and by the asymptotic method of a thin shock layer with epsilon upsilon -1 as the small parameter upsilon- adiabatic exponent) and with appropriate boundary conditions at the shock wave front. Consideration is taken of the law of momentum conservation and the condition of continuity for the tangential velocity component as well as for Euler and Lagrange variables. Emergence of the shock wave at the body surface, at the poles first, results in formation of jets associated with expansion of a gas into vacuum.

46834 **(N—8424512) An X-ray survey of variable radio bright quasars.** Henriksen, M.J.; Marshall, F.E.; Mushotzky, R.F. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Apr 1984. 28p. (NASA-TM—86094). NTIS, PC A03/MF A01.

A sample consisting primarily of radio bright quasars was observed in X-rays with the Einstein Observatory for times ranging from 1500 to 5000 seconds. Detected sources had luminosities ranging from 0.2 to 41.0 x 10 to the 45th power ergs/sec in the 0.5 to 4.5 keV band. Three of the fourteen objects which were reobserved showed flux increases greater than a factor of two on a time scale greater than six months. No variability was detected during the individual observations. The optical and X-ray luminosities are correlated, which suggests a common origin. However, the relationship (L sub x is approximately L sub op to the (.89 + or - .15)) found for historic radio variables may be significantly different than that reported for other radio bright sources. Some of the observed X-ray fluxes were substantially below the predicted self-Compton flux, assuming incoherent synchrotron emission and using VLBI results to constrain the size of the emission region, which suggests relativistic expansion in these sources. Normal CIV emission in two of the sources with an overpredicted Compton component suggests that although they, like BL Lac objects, have highly relativistic material apparently moving at small angle to the line of sight, they have a smaller fraction of the continuum component in the beam.

46835 **(SAND—84-1780C) Laboratory electron beam simulation of cosmic radio jets.** Spulak, R.G. Jr.; Burns, J.O. (Sandia National Labs., Albuquerque, NM (USA); New Mexico Univ., Albuquerque (USA)). 1984. Contract AC04-76DP00789. 15p. (CONF-840791—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016179.

From Workshop on physics of energy transport in extragalactic radio sources; Green Bank, WV, USA (30 Jul 1984).

Astrophysical jets are injections of particles, magnetic fields, and possibly large-scale currents into a background plasma, the intergalactic medium. In principle, they are therefore somewhat similar to the laboratory injection of an electron beam into a plasma. We consider scaling between the astrophysical and laboratory cases and discuss the similarities and differences between them. We discuss what aspects of the physics of astrophysical jets might be investigated with electron beam experiments; in general, the laboratory will be most useful to study purely electrodynamic effects.

46836 **Collisionless damping of density fluctuations in an expanding universe.** Bond, J.R.; Szalay, A.S. (Institute of Theoretical Physics, Department of Physics, Stanford University). *Astrophysical Journal;* 274: No. 2, 443-468(15 Nov 1983). Contract AC02-80ER10773.

The best candidate for the dark matter is a massive collisionless non-baryonic relic of the early universe. The most natural type of initial density fluctuations expected are of the adiabatic rather than of the isothermal type. We calculate the temporal evolution of the (initially adiabatic) fluctuation spectrum by numerical integra-

tion of the coupled Einstein-Boltzmann equations for scalar perturbations in the metric and in the density of photons, neutrinos, and collisionless relics. Our output linear perturbation spectrum, which is itself input to the nonlinear problem of large scale structure formation, is shown to be characterized by two scales: the damping mass and the horizon mass when the energy density in relativistic particles equals that in nonrelativistic ones, M/sub H/eq. Collisionless relics which decouple when relativistic may be of two basic types if they are to dominate the mass of the universe: massive neutrinos of 10—100 eV, or massive gravitinos (or other weakly interacting particles) of mass about 1 keV. For massive neutrinos, both scales are of supercluster size; and the Zel'dovich pancake picture, in which a large scale is the first to collapse, is expected, regardless of initial spectrum. For massive gravitinos, the damping mass is of galactic scale. Depending upon the initial spectrum, one can get either hierarchical clustering from the damping scale upward or fragmentation of the large M/sub H/eq scale. Collisionless relics which decouple when nonrelativistic have negligible damping masses; again, hierarchical clustering from very small scales or large scale fragmentation is possible in this adiabatic picture.

46837 **Further comments on the KONUS catalog.** Laros, J.G.; Evans, W.D.; Fenimore, E.E.; Klebesadel, R.W.K. (Los Alamos National Lab., NM). *Astrophysics and Space Science;* **96**: No. 1, 213-215(Oct 1983).

Questions about the experimental methods and results of the KONUS experiment are posed. It is found that several problems in the gamma-burst catalog Mazets et al., (1981) were not fully addressed by the recent response of Mazets and Golenetskii (1982) to the analysis of Laros et al., (1982). Calibration, correction for selective spatial coverage, and comparison with the Pioneer Venus Orbiter catalog are discussed. Further clarification from scientists familiar with the details of the KONUS experiment is considered necessary if the valuable data contained in the catalog are to be fully exploited.

6402 Atmospheric Physics

46838 **(AD-A—140585/1) Ionospheric gravity waves from nuclear surface bursts. Final report 14 Nov 83-31 Jan 84.** Goldflam, R.; McCartor, G.; Wortman, B. (Mission Research Corp., Santa Barbara, CA (USA)). 15 Mar 1984. 67p. (MRC-R—825). NTIS, PC A04/MF A01.

The rising fireball and the blast wave are investigated as possible sources of atmospheric gravity waves in a stratified medium (isothermal atmosphere) using previously developed methods. Exact and approximate calculations are carried out and the results are compared with observations. We conclude that the blast wave is the predominant source of large amplitude gravity waves.

46839 **(LA-UR—84-1992) Plasma flow in the near and distant geomagnetic tail.** Hones, E.W. Jr. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 43p. (CONF-8406167—3). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84014029.

From 25. plenary session of COSPAR; Graz, Austria (25 Jun 1984).

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Measurements of the bulk flow of plasma in the outer magnetosphere were first made a little over a decade ago with Los Alamos instruments on the Vela satellites. During the invervening years, as flow measurements have been made with improved instruments and by other satellites they have come to play a crucial role in the development of our understanding of the structure and dynamics of the magnetosphere. For example, they were the means of discovery of the magnetosphere's boundary layer and of plasma vortices within the plasma sheet. They were the essential ingredient in the identification of signatures of magnetic reconnection at the magnetopause. And they were indispensable in clarifying the complex phenomena in the magnetotail accompanying substorms and in showing that these phenomena are consistent with a substorm model involving magnetic reconnection at a near-earth neutral line. Most recently, magnetotail plasma flow measurements by the ISEE-3 satellite at distances as great as 230 R/sub E/ have been instrumental in fixing the average location of the distant neutral line at ~ 60 to 120 R/sub E/ and in identifying plasmoids (i.e., severed sections of the plasma sheet), released during substorms and escaping down-tail. This paper reviews the features of magnetotail plasma flow, describes the most recent observations, and discusses their implications for magnetospheric physics.

46840 **(LA-UR—84-2611) Hot plasma and energetic particles in the earth's outer magnetosphere: new understandings during the IMS.** Baker, D.N.; Fritz, T.A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 13p. (CONF-8406167—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016826.

From 25. plenary session of COSPAR; Graz, Austria (25 Jun 1984).

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In this paper we review the major accomplishments made during the IMS period in clarifying magnetospheric particle variations in the region from roughly geostationary orbit altitudes into the deep magnetotail. We divide our review into three topic areas: (1) acceleration processes; (2) transport processes; and (3) loss processes. Many of the changes in hot plasmas and energetic particle populations are often found to be related intimately to geomagnetic storm and magnetospheric substorm effects and, therefore, substantial emphasis is given to these aspects of particle variations in this review. The IMS data, taken as a body, allow a reasonably unified view as one traces magnetospheric particles from their acceleration source through the plasma sheet and outer trapping regions and, finally, to their loss via ionospheric precipitation and ring current formation processes. It is this underlying, unifying theme which is pursued here. 52 references, 19 figures.

46841 **(N—84-13049) Structure of the plasma sheet-lobe boundary in the Earth's magnetotail.** Orsini, S.; Candidi, M.; Formisano, V. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Sep 1982. 33p. (NASA-TM—85434). NTIS, PC A03/MF A01.

The structure of the magnetotail plasma sheet-plasma lobe boundary was studied by observing the properties of tailward flowing O+ ion beams, detected by the ISEE 2 plasma experiment inside the boundary during three time periods. The computed value of the north-south electric field component as well as the O+ parameters are shown to change at the boundary. The results are related to other observations made in this region. The O+ parameters and the Ez component behavior are shown to be consistent with that expected from the topology of the electric field lines in the tail as mapped from the ionosphere. (ESA)

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 64030046521

46842 **(ANL—83-95) Atomic spectrum of plutonium.** Blaise, J.; Fred, M.; Gutmacher, R.G. (Argonne National Lab., IL (USA)). Aug 1984. Contract W-31-109-ENG-38. 613p. NTIS, PC AA99/MF A01; 1; GPO Dep. File Number DE84017438.

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This report contains plutonium wavelengths, energy level classifications, and other spectroscopic data accumulated over the past twenty years at Laboratoire Aime Cotton (LAC) Argonne National Laboratory (ANL), and Lawrence Livermore National Laboratory (LLNL). The primary purpose was term analysis: deriving the energy levels in terms of quantum numbers and electron configurations, and evaluating the Slater-Condon and other parameters from the levels.

46843 (ARL/TR—060, pp 93) **Fluorescence yield and Coster-Kronig transition probability for the L_2 subshell of Ra, Th, Pa, U, Np and Pu.** Johnston, P.N.; Moroney, J.R.; Burns, P.A. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

46844 (ARL/TR—060, pp 95) **Measurement of absolute emission rates of L X-rays.** Burns, P.A.; Johnston, P.N.; Moroney, J.R. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

46845 (CONF-840829—1) **Inclusion of electron transfer in the calculation of K/sup n/L/sup v/ multiple vacancy production by ion impact.** Becker, R.L.; Ford, A.L.; Reading, J.F. (Oak Ridge National Lab., TN (USA); Texas A and M Univ., College Station (USA)). 1984. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016596.

From International conference on x-ray and inner-shell processes in atoms, molecules and solids; Leipzig, Germany D.R. (20 Aug 1984).

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Measurements of K x-ray or Auger satellite (and hypersatellite) intensities provide information on KL/sup v/ (and K^2L/sup v/) hole production in close collisions of ions with atoms. The L-shell vacancy distributions usually are nearly binomial. The binomial distribution follows immediately from a statistical model in which the creations of the various holes are regarded as mutually independent. This distribution is specified by a single parameter, p, the mean L-shell vacancy probability per electron, which can depend on the speed v, the nuclear charge Z and the ionic charge q of the projectile, and on the nuclear charge of the target. Almost all calculations of p, aside from our work, have been limited to first-order collision approximations. Moreover, all such calculations have included only impact ionization and, consequently, have neglected electron transfer to the projectile. The first-order calculations have had enough success for proton and alpha-particle impact to remain in vogue for a decade, but they predict that p is proportional to Z^2, whereas anti p must remain less than or equal to 1, which requires a unitary collision approximation. We have obtained the saturation of p with Z in two unitary schemes, the first Magnus approximation and the more refined coupled-channel approximation. In both schemes we used a single-centered expansion (SCE) in spin-orbitals representing bound and unbound states of the target. Typically, we employ ten radial functions for each of four angular momenta (s, p, d, and f states).

46846 (CONF-8308192—1) **Electron capture by multiply charged ions from hydrogen atoms at low energies.** Phaneuf, R.A. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016560.

From 8. international seminar on ion-atom collisions; Utrecht, Netherlands (4 Aug 1983).

At collision velocities which are slow compared to the motion of the ls hydrogenic electron, electron capture by multiply charged ions from hydrogen atoms is best characterized in terms of a quasimolecular model for the interaction. The capture process is represented as a transition between the stationary states of the quasimolecule. Predicted cross sections depend strongly on the internuclear distance at which the relevant potential energy curves have minimum separation, or cross, and on the dynamics of the coupling between the stationary states. 9 references.

46847 (CONF-8409129—1) **Photoionization of excited molecular states.** Dehmer, P.M.; Dehmer, J.L.; Pratt, S.T. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017454.

From 3. international conference on multiphoton processes; Iraklion, Crete, Greece (4 Sep 1984).

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Rapid advances in laser and detector technologies are making it possible to investigate molecular photophysics and photochemistry in powerful new ways. For example, resonantly enhanced multiphoton ionization (REMPI) measurements, in which the total (or the mass selected) ion current is monitored as a function of laser wavelength, have yielded extensive and often novel information on the spectroscopy of the resonant intermediate states. With the addition of photoelectron spectrometry (PES) to analyze the kinetic energy of the ejected electrons, it is possible to determine the branching ratios into different electronic, vibrational, and rotational levels of the product ion and to focus directly on both the dynamics of the multiphoton ionization process and the photoionization of excited state species. In the present paper, we report several REMPI/PES studies of H_2 and N_2. The results reflect both the spectroscopy and the dynamics of photoionization of excited molecular states and are discussed in terms of the selection rules for photoionization and the relative probabilities of photoionization from Rydberg and valence states. In some cases, in accordance with the Franck-Condon principle, the results demonstrate that resonant multiphoton ionization through Rydberg states may be a powerful technique for the production of electronic, vibrational, and rotational state selected ions. However, in other cases, systematic departures from Franck-Condon behavior are observed, which reflect the more subtle dynamics of excited state photoionization.

46848 (DOE/NBM—4017488) **Notes for lectures in China: distribution of the oscillator strength over the entire range of excitation energy for atoms, molecules, and solids.** Inokuti, M. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017488.

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Consider the intensity of absorption of a photon (i.e., the photoabsorption cross section) as a function of photon energy E. Apart from some intensity related to pure nuclear motion and spins, the (electronic) absorption begins at several eV (i.e., in the visible region or the near ultraviolet region). It becomes stronger at tens of eV's (i.e., in the far ultraviolet), and gradually diminishes at higher E. However, the intensity enhances again as E becomes comparable to an inner-shell binding energy. This repeats throughout the x-ray region until E greatly exceeds the K-shell binding energy. I shall discuss the gross variation of the absorption intensity with E. This intensity, suitably normalized, is the oscillator-strength distribution df/dE.

46849 (LA—10149-T) **Stark broadening of H^- resonances in large electric fields.** Butterfield, K.B. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 165p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE84016974.

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Resonances in the H^- ion near the n=2 energy of H^0 were studied in very large electric fields. The experiments used the 800 MeV H^- ion beam at the Clinton P. Anderson Meson Physics Facility (LAMPF) at Los Alamos, New Mexico. Third harmonic photons (3.5 eV) from a Nd:YAG laser were Doppler tuned to produce the 11 eV photons required to excite the resonances. A magnetic field perpendicular to the H^- velocity appeared via the Lorentz transformation as a very large electric field in the center of mass frame of reference. The magnetic fields were produced by a pulsed power supply driving a Helmholtz coil. The maximum field used (3 MV/cm) was sufficient to field ionize enough of the H^- beam, within the 1.5 cm high field region, to saturate the detectors. The onset of field ionization was observed to be at 2.5 MV/cm. Surprisingly, the $^1P^0$ shape resonance and ^1D/sup e/ resonance were not quenched by the largest fields used. Cross sections for these resonances were measured at several lesser fields, and widths, centroid energies, and strengths for each resonance were determined. The cross section for producing H^0 (n=2) was measured for the first time and the Fano function was shown to be inadequate to describe the shape resonance. 108 references, 33 figures, 3 tables.

46850 (LBL—18161) **X-ray $L\beta Z_{15}$ emission spectrum of Ru in $Ru(NH_3)_6Cl_3$.** Perera, R.C.C.; Barth, J.; LaVilla, R.E.; Nordling, C. (Lawrence Berkeley Lab., CA (USA); IBM Watson Research Center, Yorktown Heights, NY (USA); National Bureau of Standards, Washington, DC (USA). Quantum Metrology Group; Uppsala Univ. (Sweden). Fysiska Institutionen). Jul 1984. Contract AC03-76SF00098. 5p. (CONF-840764—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016881.

From 3. international EXAFS conference; Stanford, CA, USA (16 Jul 1984).

One of the broader applications of synchrotron radiation has been to EXAFS studies for material structure determination, i.e., for an analysis of x-ray absorption over an extended energy region beyond a core ionization limit. Studies of the near edge structure (XANES) give a different type of information, characteristic of the local symmetry and electronic configuration of the absorbing atom. This type of information is reflected also in the x-ray emission spectra, in particular for transitions involving the valence levels. Examination of the near edge absorption or the emission spectrum does not require an instrument capable of scanning a wide energy range with high counting statistics, as does EXAFS; the needs are rather for good resolution and a reliable calibration of the energy scale. Some of the problems of near edge spectra were particularly evident in our investigation of Ru-L$\beta_{2\ 15}$ emission from $Ru(NH_3)_6Cl_3$. The Ru-L$\beta_{2\ 15}$ emission was measured with a laboratory Rowland circle x-ray spectrometer with a curved quartz (1010) crystal (radius = 22 inches) in a fixed position appropriate to the energy range, and a position sensitive detector which can be positioned along the Rowland circle. The Ru spectrum was excited mainly by Sn-L/sub α/ primary radiation from a Sn anode in a demountable x-ray tube operating at 13 kV and 120 mA. The resolution of the instrument in this region is 1.5 eV. An accurate calibration of the energy scale was conveniently obtained by measuring a reference x-ray emission line in the same instrumental configuration. In the present case the Pd-L/sub α/ emission line at 2838 eV was used to establish the energy scale. The energy dispersion of the instrument was determined from the Cl-K/sub β/ emission spectrum of CH_3Cl between 2810 eV and 2830 eV and Pd-L$\alpha_{1\ 2}$ and extrapolated to the energy region of the recorded emission spectrum. 6 references, 1 figure.

46851 **(N—84-12834) International conference on vibrations at surfaces (3rd).** Morawitz, H. (National Science Foundation, Washington, DC (USA)). Sep 1982. 124p. (AD-A—131794; AFOSR—83-0647TR; CONF-820977—). NTIS, PC A06/MF A01.

From 3. international conference on vibrations at surfaces; Pacific Grove, CA, USA (1 Sep 1982).

Topics related to vibration phenomena at surfaces are addressed including vibrational frequency shifts and widths, dynamical processes, electron loss spectroscopy, Raman scattering, infrared adsorption and reflection spectroscopy, beam surface scattering, and electron tunnelling spectroscopy.

46852 **(N—84-12912) Cross sections for charge transfers of highly ionized ions in hydrogen atoms.** Tawara, H.; Kato, T.; Nakai, Y. (Nagoya Univ. (Japan)). Aug 1983. 114p. (IPPJ-AM—30). NTIS, PC A03/MF A01.

Experimental data through mid 1983 are compiled on the total cross sections for the electron capture processes of highly ionized ions in collisions with hydrogen atoms. The results are shown in figures as a function of the collision energy. The cross sections for some related processes including electron detachment (or stripping) and excitation are also shown. This is the first up-dated version of IPPJ-AM-15.

46853 **(N—84-13933) The Marshall Space Flight Center Low-Energy Ion Facility: a preliminary report.** Biddle, A.P.; Reynolds, J.W.; Chisholm, W.L. Jr.; Hunt, R.D. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Oct 1983. 25p. (NASA-TM—82559). NTIS, PC A02/MF A01.

The Low-Energy Ion Facility (LEIF) is designed for laboratory research of low-energy ion beams similar to those present in the magnetosphere. In addition, it provides the ability to develop and calibrate low-energy, less than 50 eV, plasma instrumentation over its full range of energy, mass, flux, and arrival angle. The current status of this evolving resource is described. It also provides necessary information to allow users to utilize it most efficiently.

46854 **(N—8423689) Theoretical predictions of excitation cross sections for collisions of HF, HCl, CO, H/sub 2/O, and CO/sub 2/ with O(sup 3P).** Redmon, M.J.; Garrett, B.C.; Redmon, L.T. (Chemical Dynamics Corp., Columbus, OH (USA)). 1983. 7p. NTIS, PC A07/MF A01.

The methodology of modern theoretical chemistry is applied to the prediction of excitation cross sections for a variety of plume species colliding with atomic oxygen. The relative velocity range considered is 4 to 10 km/sec. Reported cross sections generally rise to values of from several tenths to several square angstroms at the highest velocities. Although accurate predictions of the cross sections are generally obtained for transitions involving only small changes of vibrational quantum number, estimates are available for cross sections for many energetically accessible processes.

46855 **(SLAC-PUB—3401) Parity and time-reversal nonconservation in atoms.** Lynn, B.W. (Stanford Linear Accelerator Center, CA (USA); Oxford Univ. (UK). Clarendon Lab.). Aug 1984. Contract AC03-76SF00515. 13p. (CONF-840786—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016924.

From 9. international conference on atomic physics; Seattle, WA, USA (23 Jul 1984).

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We examine the implications of parity and time-reversal nonconservation for atomic physics. We conclude that a determination of Q/sub W//N to 10% would give an indirect determination of M/sub Z/ competitive with that available from high-energy physics, limits on the electric dipole moments of neutrons and electrons give non-trivial constraints on model building of CP non-conservation.

46856 **Generation of negative ions in tandem high-density hydrogen discharges.** Hiskes, J.R.; Karo, A.M. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Applied Physics;* **56**: No. 7, 1927-1938(1 Oct 1984). Contract W-7405-ENG-48.

An optimized tandem two-chamber negative-ion source system is discussed. In the first chamber high-energy (E>20 eV) electron collisions provide for H_2 vibrational excitation, while in the second chamber negative ions are formed by dissociative attachment. The gas density, electron density, and system scale length are varied as independent parameters. The extracted negative ion current density passes through a maximum as electron and gas densities are varied. This maximum scales inversely with system scale length R. The optimum extracted current densities occur for electron densities $nR = 10^{13}$ electrons cm^{-2} and gas densities N_2R in the range 10^{14}—10^{15} molecules cm^{-2}. The extracted current densities are sensitive to the atomic concentration in the discharge. The atomic concentration is parametrized by the wall recombination coefficient γ and scale length R. As γ ranges from 0.1 to 1.0 and for system scale lengths of 1 cm, extracted current densities range from 8.0 to 80 mA cm^{-2}. The relative negative-ion yields from single-chamber and tandem two-chamber systems are compared. Estimates are made for the rates of polar dissociation of H_2 molecules and H^+_3 ions, and these rates are compared with the dissociative attachment rates.

46857 **Shape resonances in the hydrogen Stark effect in fields up to 3 MV/cm.** Bergeman, T.; Harvey, C.; Butterfield, K.B.; Bryant, H.C.; Clark, D.A.; Gram, P.A.M.; MacArthur, D.; Davis, M.; Donahue, a.J.B.; Dayton, J.; Smith, W.W. (State University of New York at Stony Brook, Stony Brook, New York 11794). *Physical Review Letters;* **53**: No. 8, 775-778(20 Aug 1984).

We observe the Stark effect in hydrogen by photoionizing a relativistic hydrogen beam prepared by photodetachment of the 800-MeV H^- beam at the Clinton P. Anderson Meson Physics Facility. Photoexcitation of H^0 is performed in a magnetic field (up to 6.5 kG) that appears in the atomic frame as an electric field up to 3 MV/cm. Resonances observed with an angle Doppler-tuned laser beam match calculated energies. At sufficiently high field, near the Stark-Coulomb potential-barrier peak, we observe shape resonances with an apparent elevation of the baseline on the high-energy side.

46858 **Interaction matrix elements for resonant muonic-molecule formation.** Cohen, J.S.; Martin, R.L. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **53**: No. 7, 738-738(13 Aug 1984).

A Comment on the Letter by M. Leon, Phys. Rev. Lett. 52, 605 (1984).

46859 Fine and hyperfine structure of the Li^- spectrum. Cheng, K.T.; Hardis, J.E.; Dehm, E.J.; Beck, D.R. (Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] A: General Physics;* **30**: No. 2, 698-702(Aug 1984). Contract W-31-109-ENG-38.

The fine and hyperfine structures of the doubly excited, quintet states of the $^7Li^-$ ion are of comparable magnitude. This leads to strong second-order hyperfine corrections and to significant distortion of the Lande interval rule. We discuss the results of our many-body calculations in this system, and also in the analogous lithium quartet systems for which experimental data exist. We find that the hyperfine matrix elements of these few-electron systems may be adequately computed without detailed consideration of the electron correlations. Fine structure is significantly affected by such correlations. Experimental verification of the Li^- structure is underway.

46860 Semiempirical Sternheimer shielding factors for the atomic 4f and 5d shells. Childs, W.J.; Cheng, K.T. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] A: General Physics;* **30**: No. 2, 677-682(Aug 1984). Contract W-31-109-ENG-38.

Sternheimer shielding factors are often obtained empirically by comparing nuclear electric quadrupole moment values derived from the hyperfine structure (hfs) of many-electron atoms with those determined by Coulomb-excitation or mesic-atom measurements. A large scatter in the resulting shielding factors arises from the lack of consistency in the approaches used in the analyses of the hfs. In the present work the radial hfs integrals are evaluated with a consistent configuration-average Dirac-Fock method. The scatter in the shielding factors obtained is reduced substantially and the results are in reasonable agreement with Sternheimer's original estimates.

46861 Low-energy K^+-ion scattering as a probe of adsorbate ordering. DeKoven, B.M.; Overbury, S.H.; Stair, P.C. (Chemistry Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review Letters;* **53**: No. 5, 481-484(30 Jul 1984). Contract AC05-84OR21400.

Overlayers of C, N, and O on Mo(001) have been studied by 500-eV K^+-ion scattering. The energy distributions and their dependence upon incident angle are found to depend strongly upon coverage and annealing temperature. Enhanced specular scattering is extremely sensitive to changes in adsorbate ordering observed by low-energy electron diffraction. The enhancement is explained by a novel scattering mechanism discovered by computer simulation.

46862 Observation of radiative capture in relativistic heavy-ion—atom collisions. Anholt, R.; Andriamonje, S.A.; Morenzoni, E.; Stoller, C.; Molitoris, J.D.; Meyerhof, W.E.; Bowman, H.; Xu, J.; Xu, Z.; Rasmussen, A.J.O. (Department of Physics, Stanford University, Stanford, California 94305). *Physical Review Letters;* **53**: No. 3, 234-237(16 Jul 1984). Contract AC03-76SF00098.

X-ray studies of relativistic heavy-ion—atom collisions allow the direct observation of the radiative-electron-capture photons. The angular distribution of these photons is approximately $\sin^2\theta/$ sub lab/, because of the cancellation of electron retardation effects when the cross sections are subjected to Lorentz transformation into the laboratory frame. Comparison of measured and calculated cross sections reveals the number of equilibrium projectile K vacancies present in the solid targets, which can be compared with charge-state measurements behind the target.

46863 High-resolution C 1s and O 1s core-excitation spectroscopy of chemisorbed, physisorbed, and free CO. Jugnet, Y.; Himpsel, F.J.; Avouris, P.; Koch, E.E. (IBM Thomas J. Watson Research Center, Yorktown Heights, New York 10598). *Physical Review Letters;* **53**: No. 2, 198-201(9 Jul 1984). Contract AC02-76CH00016.

High-resolution soft-x-ray excitation spectra are reported for free CO, Co condensed on Au at ~20 K, and CO chemisorbed on Ni(111). Chemisorption increases dramatically the widths of the C and O 1s→2π(transitions from <0.2 to 2.2 eV for C 1s and from 1.15 to 3.5 eV for O 1s. Shifts of 0.3 eV (for C 1s) and 1.7 eV (for O 1s) towards lower energy are resolved for the first time and are explained in terms of the electronic distribution in excited CO.

46864 Gasdynamic focusing for sample concentration in ultrasensitive analysis. Keller, R.A.; Nogar, N.S. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Applied Optics;* **23**: No. 13, 2146-2151(1 Jul 1984).

The principle of hydrodynamic focusing is applied to flowing gas streams for sample concentration in ultrasensitive analysis. In a concentric nozzle system, samples introduced from the inner nozzles in the converging section of the outer nozzle are focused to streams 50—250 μm in diameter. In some cases diameters of ~100 μm are maintained for several centimeters downstream from the exit of the outer nozzle. This technique is particularly useful for concentrating samples to match the beam waist of focused laser beams. Applications to resonance ionization mass spectrometry are discussed.

46865 Atomic weights of the elements 1983. Holden, N.E.; Martin, R.L. (Brookhaven National Lab., Upton, NY). *Pure and Applied Chemistry;* **56**: No. 6, 653-674(Jun 1984).

The biennial review of atomic weight, Asub(r)(E), determinations and other cognate data have resulted in the following changes in recommended values (1981 values in parentheses): helium 4.002602 +- 2 (4.00260 +- 1); lithium 6.941 +- 2 (6.941 +- 3); boron 10.811 +- 5 (10.81 +- 1); sulfur 32.066 +- 6 (32.06 +- 1); calcium 40.078 +- 4 (40.08 +- 1); scandium 44.95591 +- 1 (44.9559 +- 1); chromium 51.9961 +- 6 (51.996 +- 1); zinc 65.39 +- 2 (65.38 +- 1); gallium 69.723 +- 4 (69.72 +- 1); zirconium 91.224 +- 2 (91.22 +- 1); ruthenium 101.07 +- 2 (101.07 +- 3); tin 118.710 +- 7 (118.69 +- 3). These values are incorporated in the Table of Standard Atomic Weights of the Elements 1983. The Table lists estimated uncertainties between +- 1 and +- 9 in the last tabulated figure, which represents a departure from the practice in prior years of restricting uncertainties to two alternative values, either +- 1 or +- 3. Annotations in Tables 1 and 2 have been changed for several of the elements and element 107 is included in the table of Relative Atomic Masses and Half-lives of Selected Radionuclides for the first time. The Report summarizes those elements of non-terrestrial origin for which variations in isotopic composition have been found and categorizes them by their cause from mass fractionation, nuclear reactions or solar wind.

46866 Isotopic compositions of the elements 1983. Holden, N.E.; Martin, R.L.; Barnes, I.L. (Brookhaven National Lab., Upton, NY). *Pure and Applied Chemistry;* **56**: No. 6, 675-694(Jun 1984).

The Commission's biennial review of isotopic compositions as determined by mass spectrometry and other relevant methods has been undertaken by the Subcommittee for the Assessment of Isotopic Composition (SAIC). The Subcommittee's critical evaluation of the published literature element by element forms the basis of the Table of Isotopic Compositions as Determined by Mass Spectrometry, 1983, which is presented in this Report. Atomic Weights calculated from the tabulated isotopic abundances are consistent with Asub(r)(E) values listed in the Table of Standard Atomic Weights 1983.

46867 Element by element review of their atomic weights. Peiser, H.S.; Holden, N.E.; Bievre, P. de. (Brookhaven National Lab., Upton, NY). *Pure and Applied Chemistry;* **56**: No. 6, 695-768(Jun 1984).

The IUPAC 'standard' atomic weights of the terrestrially occurring chemical elements are individually reviewed tracing changes during the past 25 years. Emphasized is the relevant published scientific evidence which in each case constitutes the basis for the expert judgment by the responsible IUPAC Commission. It biennially reports on, recommends, and tabulates the best values of these atomic weights with an implied judgment of their individual reliability. In the introductory part of this Review the history of atomic-weight determinations is sketched. The IUPAC leadership in this data-evaluation project is described as it benefits science, technology, and trade. The remaining experimental uncertainties

and natural variabilities are discussed. The treatment of abnormal materials is explained. The principal techniques for determining atomic weights are outlined. The effects of naturally occurring radioactive nuclides are characterized in their essentials.

46868 **Electronic excitation of atoms and molecules by electron impact in a linear algebraic, separable potential approach.** Collins, L.A.; Schneider, B.I. (Los Alamos National Lab., NM). *Journal of Physics B: Atomic and Molecular Physics;* **17**: No. 7, L235-L239(14 Apr 1984).

The linear algebraic, separable potential approach is applied to the electronic excitation of atoms and molecules by electron impact. By representing the exchange and off-diagonal direct terms on a basis, the standard set of coupled inelastic equations is reduced to a set of elastic inhomogeneous equations. The procedure greatly simplifies the formulation by allowing a large portion of the problem to be handled by standard bound-state techniques and by greatly reducing the order of the scattering equations that must be solved. Application is made to the excitation of atomic hydrogen in the three-state close-coupling (1s, 2s, 2p) approximation.

46869 **Hyperfine structure of 4f/sup N/ 6s^2 configurations in ^{159}Tb, /sup 161,163/Dy and ^{169}Tm.** Childs, W.J.; Crosswhite, H.; Goodman, L.S.; Pfeufer, V. (Argonne National Laboratory, Argonne, Illinois 60439). *Journal of the Optical Society of America B: Optical Physics;* **1**: No. 1, 22-29(Mar 1984).

The atomic-beam laser-RF, double-resonance method has been used to measure the hyperfine structure in excited levels of the 4f/sup N/ 6s^2 configurations of the neutral rare earths ^{159}Tb, / sup 161,163/Dy and ^{169}Tm. On combining the new information with earlier results for the lower levels, it is possible to extract many of the hyperfine radial integrals ($<r^{-3}>$/sub x/y). The present results, together with work published during the last year on ^{165}Ho and ^{167}Er, now make it possible to plot the values of the integrals completely across the 4f shell. The ab initio calculations of Lindgren and Rosen reproduce the magnetic-dipole hfs integrals well but appear to overestimate the electric-quadrupole integrals $<r^{-3}>_{11}$ and $<r^{-3}>_{13}$.

46870 **J dependence of the isotope shift in the ground term of dysprosium I.** Pfeufer, V.; Childs, W.J.; Goodman, L.S. (Argonne National Laboratory, Argonne, Illinois 60439). *Journal of the Optical Society of America B: Optical Physics;* **1**: No. 1, 34-37(Mar 1984).

High-resolution laser-atomic-beam measurements have been made to study the J dependence in the optical isotope shift of the ground term 4f^{10} 6s^{2}I of the naturally occurring dysprosium isotopes 160, 161, 162, 163, and 164. For each isotope pair with mass numbers A and A', this J dependence is described through one parameter z/sup AAprime/$_4$/sub f/, whose angular coefficient for a level is equal to that of the spin-orbit radial integral zeta$_4$/sub f/. The J dependence can be explained by field-shift-crossed second-order effects.

46871 **Electronic excitation of Ti atoms sputtered by energetic Ar$^+$ and He$^+$ from clean and monolayer oxygen covered surfaces.** Pellin, M.J.; Gruen, D.M.; Young, C.E.; Wiggins, M.D. (Argonne National Lab., IL (USA). Materials Science Div.; Argonne National Lab., IL (USA). Chemistry Div.). *Nuclear Instruments and Methods in Physics Research;* **218**: No. 1-3, 771-776(15 Dec 1983). (CONF-830570—). Contract W-31-109-ENG-38.

From 6. international conference on ion beam analysis; Temple, AZ, USA (22 May 1983).

With 31 refs.

Electronic excitation of Ti atoms ejected during energetic ion bombardment (Ar$^+$, He$^+$) of well characterized clean and oxygen covered polycrystalline Ti metal surfaces has been determined. For states with 0 to 2 eV and 3 to 5.5 eV of electronic energy, static mode laser fluorescence spectroscopy (LFS) and static mode spontaneous fluorescence spectroscopy (SFS) were used respectively. These experiments which were carried out in a UHV ($<10^{-10}$ Torr) system equipped with an Auger spectrometer provide measurements of the correlation between oxygen coverage (0 to 3 monolayers) and the excited state distribution of sputtered Ti atoms. The experimentally determined electronic partition function of Ti atoms does not show an exponential dependence on energy (E) above the ground state but rather an E^{-2} or E^{-3} power law dependence.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 64041046415

46872 **(LBL—17735) Dynamics of liquid filament breakup.** Bousfield, D.W.; Marrucci, G.; Denn, M.M. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 10p. (CONF-841076—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016008.

From 9. international congress on rheology; Acapulco, Mexico (8 Oct 1984).

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The nonlinear growth of surface tension-driven disturbances leading to breakup of a liquid filament is studied, using a one-dimensional approximation of the filament dynamics. The results are consistent with linear stability analyses during the initial portion of the transient, but also enable calculations at long times approaching breakup. Nonlinearities associated with inertial stresses lead to the formation of satellite droplets for Newtonian jets. The retardation of disturbance growth and stabilization of viscoelastic jets at long times is shown to be a consequence of nonlinearities associated with the buildup of large extensional stresses.

46873 **(LBL—17968) Finite element method for a class of viscoelastic flows in deforming domains applied to jet breakup.** Keunings, R. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 13p. (CONF-841076—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84014571.

From 9. international congress on rheology; Acapulco, Mexico (8 Oct 1984).

Portions are illegible in microfiche products.

A numerical method for solving a class of transient viscoelastic flows in domains with free boundaries is based on a Galerkin/Finite Element technique combined with a predictor-corrector scheme that allows for the prediction of stress field, velocity field and flow domain as a function of time. The numerical procedure is applied to the analysis of surface-tension-driven breakup of liquid jets. We study the nonlinear growth of a periodic disturbance imposed on an infinitely long jet and leading to breakup. In the Newtonian case, we predict the birth of satellite drops when inertia forces are present. Results for an Oldroyd fluid show that elasticity accelerates the breakup process at short times which is consistent with linear stability analyses. However, this tendency is dramatically reversed at later times when a pattern of drops connected by remarkably stable filaments is obtained. We thus predict the stabilizing effect of elastic forces, known experimentally for many years, and show that the breakup mechanism of a viscoelastic jet cannot be described by linearized dynamics.

46874 **Critical behavior of a dilute interacting Bose fluid.** Rasolt, M.; Stephen, M.J.; Fisher, M.E.; Weichman, P.B. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830 and Physics Department, Harvard University, Cambridge, Massachusetts 02138). *Physical Review Letters;* **53**: No. 8, 798-801(20 Aug 1984). Contract W-7405-ENG-26.

The crossover from critical behavior to ideal Bose-gas behavior in a dilute, weakly interacting Bose fluid at low temperatures is shown to be described by a scaling function depending on the temperature, density, and dimensionality. The results are applied to the experimental measurements of Crooker et al. on the superfluid density of ^{4}He in Vycor glass. The satisfactory agreement obtained lends support to the model of ^{4}He in Vycor as a dilute, weakly interacting, three-dimensional Bose fluid.

46875 Occurrence of isothermal discontinuities in relativistic fluids. Chapline, G.F.; Granik, A. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Physics of Fluids;* **27**: No. 8, 1991-1995(Aug 1984). Contract W-7405-ENG-48.

The effect of radiation on the appearance of an isothermal discontinuity in a relativistic shock wave is considered. When the postshock speed of sound is small compared to the speed of light, algebraic relations are found for the allowed ratios of radiation pressure to matter pressure and for the amplitude of the isothermal discontinuity.

46876 Relation of fluid drift to oscillation center drift. Cary, J.R. (Institute for Fusion Studies, University of Texas, Austin, Texas 78712). *Physics of Fluids;* **27**: No. 8, 2193(Aug 1984). Contract FG05-80ET53088.

The fluid theory and oscillation center theory of the ponderomotive drift give apparently different results. It is shown that this difference is caused by a ponderomotive diamagnetic effect.

46877 Topological symmetry breakdown in cholesterics, nematics, and ^{3}He. Balachandran, A.P.; Lizzi, F.; Rodgers, V.G.J. (Physics Department, Syracuse University, Syracuse, New York 13210). *Physical Review Letters;* **52**: No. 20, 1818-1821(14 May 1984). Contract AC02-76ER03533.

Cholesterics, uniaxial and biaxial nematics, and the dipole-free A phase of superfluid ^{3}He are characterized by order parameters which are left invariant by suitable "symmetry" groups H. We show that in the presence of defects, the full group H may not be implementable on the states because of topological obstructions. Thus H is topologically broken in the presence of suitable defects.

46878 Piecewise parabolic method (PPM) for gas-dynamical simulations. Corlella, P.; Woodward, P.R. (Lawrence Berkeley Laboratory, University of California, Berkeley, California, 94720). *Journal of Computational Physics;* **54**: No. 1, 174-201(Apr 1984). Contract AC03-76SF00098.

We present the piecewise parabolic method, a higher-order extension of of Godunov's method. There are several new features of this method which distinguish it from other higher-order Godunov-type methods. We use a higher-order spatial interpolation than previously used, which allows for a steeper representation of discontinuities, particularly contact discontinuities. We introduce a simpler and more robust algorithm for calculating the nonlinear wave interactions used to compute fluxes. Finally, we recognize the need for additional dissipation in any higher-order Godunov method of this type, and introduce it in such a way so as not to degrade the quality of the results.

46879 Exact partial solution to the compressible flow problems of jet formation and penetration in plane, steady flow. Karpp, R.R. (Los Alamos Laboratory, Los Alamos). *Quarterly of Applied Mathematics;* **42**: No. 1, 15-72(Apr 1984). Contract W-7405-ENG-36.

The particle solution of the problem of the symmetric impact of two compressible fluid stream is derived. The plane two-dimensional flow is assumed to be steady, and the inviscid compressible fluid is of the Chaplygin (tangent gas) type. The equations governing this flow are transformed to the hodograph plane where an exact, closed-form solution for the stream function is obtained. The distribution of fluid properties along the plane of symmetry and the shape of free surface streamlines are determined by transformation back to the physical plane. The problem of a compressible fluid jet penetrating an infinite target of similar material is also solved by considering a limiting case of this solution. Differences between compressible and incompressible flows of the type considered are illustrated.

46880 Nonparametric solution of the Euler equations for steady flow. Garabedian, P.R. *Communications on Pure and Applied Mathematics;* **36**: 529-535(1983). Contract AC02-76ER03077.

Starting from the variational principle a finite difference scheme for the numerical solution of Euler's equations is derived. A calculation of steady rotational flow in two dimensions is presented as an example of the method.

46881 Riemann problems for reacting gas, with applications to transition. Teng, Z.H.; Chorin, A.J.; Liu, T.P. (Peking Univ., China). *SIAM Journal on Applied Mathematics;* **42**: No. 5, 964-981(Oct 1982). Contract W-7405-ENG-48.

The authors analyze the Riemann problem for reacting gas flow, under conditions where detonations and deflagrations can occur. They show that for a given deflagration velocity law, a Riemann solution which involves a deflagration may fail to exist but a Riemann solution involving a detonation may exist instead. They use their results to study an idealized model of transition from deflagration to detonation, using the Glimm (random choice) method. Numerical and asymptotic results are given, which compare well with certain experimental data. The broader usefulness of the results is indicated. One of the most interesting features of this model is the indication it provides that no transition occurs if the flame is laminar, and thus in particular, if the flow is purely one-dimensional.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 64510047052

46882 (BNL—35107) Very high energy probes of the quark-gluon plasma. Ludlam, T.; Paige, F.; Madansky, L. (Brookhaven National Lab., Upton, NY (USA); Johns Hopkins Univ., Baltimore, MD (USA)). 1984. Contract AC02-76CH00016. 7p. (CONF-8403137—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016992.

From Workshop on detectors for relativistic nuclear collisions; Berkeley, CA, USA (26 Mar 1984).

Among the penetrating probes of nuclear matter the most frequently discussed have been those which involve the detection of photons or leptons with m/sub T/ ≃ P/sub T/ < 3 GeV. This is the expected range of emission from a hot, thermalized plasma of quarks and gluons. The suggestion has been made that in very high energy collisions of nuclei the properties of high P/sub T/ jets may also reflect the characteristics of the nuclear medium through which the parent partons have propagated just after the collision. In this note we expand on the possible uses of such a probe.

46883 (IFIN-NP—25-1983) Inelastic πi ^{3}He interactions at 145 MeV (π^+ pd - final state). Angelescu, T.; Doniciu, I.; Lazanu, I.; Mihul, A.; Naidin, A.; Pascu, L.; Ionica, R.; Falomkin, I.V.; Pontecorvo, G.B.; Shcherbakov, Iu.A. (Institutul Central de Fizica, Bucharest (Romania)). Feb 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702826.

Preliminary data on the inelastic reaction: πsup(+) ^{3}He → πsup(+) p d at 145 MeV are presented. Momentum and angular distributions are discussed.

46884 (JINR—D-1-83-686) Analysis of events with particle production in the life-time interval of 10^{-13} s for interactions of negative pions with nuclei at (50-60)GeV/c. Ali-Mussa, N.; Tolstov, K.D.; Shabratova, G.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702868.

Nine candidates to new short-lived particles have been found from 46551 inelastic interactions of negative pions with photoemulsion nuclei at (50-60) GeV/c. Some evidance for the direction selection for neutrino emission from the semileptonic decay of neutral mesons is observed. The analysis of primary interactions with the production of such candidates has been carried out. Three events can be interpreted as events of the associative production of charmed particles. The production cross section of neutral mesons is evaluated to be 17 mkb.

46885 **(JINR—E-1-83-449) Charged particle multiplicities in 40 GeV/c hadron-nucleus interactions with and without a high Psub(tr) trigger.** Boos, E.G.; Mosienko, A.M.; Pokrovskij, N.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702827.

Multiple production of hadrons from π^- -, K^- -, p^- - nucleus interactions at 40 GeV/c momentum was studied. Pure nuclear Li, C, S, Cu, CsI, Pb targets were introduced into the sensitive volume of the RISK 5-m streamer chamber. The KNO scaling holds for all nuclei including the heavy ones. A contribution of incident particle interactions with a group of mN nucleus nucleons was defined. Multiplicity, being significantly higher than that in normal inelastic interactions, was determined from π^- - nucleus interactions with a trigger particle of both signs possessing 1-2 GeV/c Psub(perpendicular) values of energy.

46886 **(SLAC—272) Radiative decays of the psi(3097) to two meson final states.** Einsweiler, K.F. (Stanford Linear Accelerator Center, CA (USA)). May 1984. Contract AC03-76SF00515. 148p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84017388.

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The MARK III detector operating at the SPEAR storage ring has acquired a sample of 2.7 x 10^6 produced psi(3097)'s. These events are used to investigate the radiative decays of the psi to two meson final states. Such decays are of topical interest because of the unusual QCD laboratory they provide - of particular interest is the possibility of observing glueball states. The process psi $\rightarrow \gamma\pi^+\pi^-$ is studied. The f(1270) tensor meson is observed and the helicity structure of its production is measured. The data indicate that helicity 2 is suppressed, in disagreement with lowest order QCD calculations. Evidence is presented for the first observation of the $\theta(1700)$ in the $\pi^+\pi^-$ final state. The strong, but not complete, suppression of this state in the $\pi\pi$ channel, combined with the absence of a J/sup P/ = 2^+ signal in a recent MARK III analysis of psi $\rightarrow$ γ rho rho, suggest a very mysterious nature for the $\theta(1700)$. The process psi $\rightarrow \gamma K^+K^-$ is also studied. The f'(1515) tensor meson is observed with a branching ratio in agreement with the SU(3) symmetry prediction for the standard two gluon radiative decay diagram with no mixing corrections. The helicity structure of the f'(1515) is measured for the first time, and is found to be similar to that of the f(1270). The $\theta(1700)$ is observed with high statistics. Its spin and parity are measured, with the result that J/sup P/ = 2^+ is preferred over J/sup P/ = 0^+ at the 99.9% C.L. In addition, evidence is presented for a remarkable narrow state, designated the $\xi(2220)$. Its parameters are measured to be: m = 2.218 +- 0.003 +- 0.010 GeV, $\Gamma \leqq 0.040$ GeV at 95% C.L., and BR(psi $\rightarrow \gamma\xi(2220))$BR($\xi(2220) \rightarrow K^+K^-$) = (5.7 +- 1.9 +- 1.4) x 10^{-5}.

46887 **(TRI-PP—83-16) Radiative capture and charge exchange of negative pions on protons at 27.4 and 39.3 MeV.** Salomon, M.; Measday, D.P.; Poutissou, J.M.; Robertson, B.C. (TRIUMF, Vancouver, British Columbia (Canada)). Mar 1983. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702825.

The $\pi^-p \rightarrow \gamma n$ and $\pi^-p \rightarrow \pi^0 n$ reactions were studied at laboratory pion kinetic energies of 27.4 and 39.3 MeV for 9 angles. The differential cross-sections of the $\pi^-p \rightarrow \gamma n$ reaction are compared with previous data and with several calculations. The $\pi^-p \rightarrow \pi^0 n$ differential cross-sections were obtained by unfolding the energy spectra of the π^0 γ-ray decays. Pion-nucleon phase shifts and scattering lengths are deduced and good agreement is obtained with the elastic channels, supporting isospin invariance.

46888 **Characteristics of proton production in jets from e^+e^- annihilation at 29 GeV.** Aihara, H.; Alston-Garnjost, M.; Badtke, D.H.; Bakken, J.A.; Barbaro-Galtieri, A.; Barnes, A.V.; Barnett, B.A.; Blumenfeld, B.J.; Bross, A.D.; Buchanan, C.D. (Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review Letters;* **53**: No. 2, 130-133(9 Jul 1984). Contract AC03-76SF00098;AM03-76SF00034;AC02-76ER03330.

Proton production in e^+e^- annihilation at 29 GeV has been studied with the time projection chamber. Measurements of the dependence of proton fractions on momentum, transverse momentum with respect to the jet axis, hadron multiplicity, and event sphericity are reported. Our results are consistent with the assumption that primary baryons and mesons have similar production spectra, and indicate that protons provide more direct probes of underlying fragmentation phenomena than do pions.

46889 **Measurement of the Cabibbo-suppressed decays tau→Kν/sub tau/ and tau→Kν/sub tau/+nπ⁰.** Mills, G.B.; Ruckstuhl, W.; Atwood, W.B.; Baillon, P.H.; Barish, B.C.; Bonneaud, G.R.; Courau, A.; Donaldson, G.J.; Dubois, R.; Duro, M.M. (California Institute of Technology, Pasadena, California 91125 and Stanford Linear Accelerator Center and Physics Department, Stanford University, Stanford, California 94305). *Physical Review Letters;* **52**: No. 22, 1944-1947(28 May 1984). Contract AC03-76SF00515;AC03-81ER40050.

The branching fractions for the Cabibbo-suppressed tau decays are measured using the DELCO detector at PEP. The results, R(tau→Kν/sub tau/) = (0.59 +- 0.18)% and R(tau→Kν/sub tau/+nπ⁰) = (1.71 +- 0.2 9)% including n = 0, are in agreement with the standard theory of sequential leptons and with tau-μ-e universality.

46890 **Search for highly-interacting, fractionally-charged particles in electron-positron annihilation at 29 GeV.** Guryn, W.; Parker, S.; Fries, R.; Besset, D.; Chew, D.M.; Ely, R.P.; Freedman, S.J.; Gobbi, B.; Harris, F.A.; Karliner, I. (Istituto Nazionale di Fisica Nucleare, Frascati, Italy). *Physics Letters, [Section] B;* **139**: No. 4, 313-319(17 May 1984).

We have searched for relativistic, highly-interacting fractionally-charged particles using the free-quark detector at the e^+e^- storage ring PEP. No convincing events were seen. For an assumed interaction cross section with matter of 100 times geometric, 90% confidence level upper limits on their production relative to $e^+e^- \rightarrow \mu^+\mu^-$ are between 0.025 and 0.49 depending on quark mass (up to 13 GeV/c^2) and reaction type. These are the first published limits on the production of fractionally charged particles with interaction cross sections of 100 times geometric or larger.

46891 **Measurements of the spin-spin correlation parameter C/sub S/S = (S,S;0,0) at 487, 639, and 791 MeV.** Ditzler, W.R.; Hill, D.; Imai, K.; Shimizu, H.; Spinka, H.; Stanek, R.; Toshioka, K.; Underwood, D.; Wagner, R.; Yokosawa, A.; Burleson, G.R.; Cottingame, W.B.; Greene, S.J.; Jarmer, J.J.; Jeppesen, R.H. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] D: Particles and Fields;* **29**: No. 9, 2137-2138(1 May 1984).

The spin-spin correlation parameter C/sub S/S = (S,S;0,0) has been measured for p-p elastic scattering over a large angular range. The data are particularly useful in checking currently available phase-shift solutions.

46892 **Search for right-handed currents in muon decay.** Carr, J.; Gidal, G.; Jodidio, A.; Shinsky, K.A.; Steiner, H.M.; Stoker, D.; Strovink, M.; Tripp, R.D. (Lawrence Berkeley Lab., CA (USA)); Gobbi, B. (Northwestern Univ., Evanston, IL (USA). Dept. of Physics); Oram, C.J. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). *Hyperfine Interactions;* **19**: No. 1-4, 887-899(Jan 1984). (CONF-830455—).

From Yamada conference on muon spin rotation and associated problems; Shimoda, Japan (18 Apr 1983).

The authors report new limits on right-handed currents, based on precise measurements of the endpoint of the e^+ spectrum from μ^+ decay. Highly polarized μ^+ from the TRIUMF 'surface' beam were stopped in pure metal foils within either an 1.1-T spin-holding logitudinal field, or a 70-gauss spin-precessing transverse field. Decay e^+ emitted within 200 mrad of the beam direction were momentum-analyzed to +-0.2%. For the spin-held data, decay via (V-A) currents requires the e^+ rate to approach zero in the beam direction at the endpoint. Measurement of this rate sets the 90% confidence limits xiPsub(μ)delta/rho > 0.9959 and M(Wsub(R)) > 380 GeV, where Wsub(R) is the possible right-

handed gauge boson. For the spin-precessed data a 90% confidence limit xiPsub(μ)delta/rho > 0.9918 was determined.

46893 **From the current literature. The discovery of intermediate bosons.** Okun', L.B. (NONE). *Soviet Physics - Uspekhi (English Translation);* **26**: No. 11, 991-992(Nov 1983).

A translation presented of the article announcing the identification of ω bosons at the CERN pp-bar collider. (AIP)

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 64520046922, 46948, 47014, 47029, 47029

46894 **(IAE—3713/1) S wave NN interaction in the quark-cluster model.** Danilin, B.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1983. 48p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE84702820.

In the framework of an interpolation cluster approach and quark model, the S wave dynamics of NN interaction has been studied. $^3S_1$ and $^1S_0$-phases of scattering, effect of six-quark (6 q) bag on the dynamics of nucleon-nucleon interaction, admixture in a deuteron of the 6 q - state and its effect on the charge form factor of a deuteron are considered.

46895 **(IFIN-FT—213-1982) Optimal inequalities for the subtraction functions of the proton Compton scattering dispersion theory.** Caprini, I. (Institutul Central de Fizica, Bucharest (Romania)). Jun 1982. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702819.

Upper and lower bounds upon the subtraction functions required in the dispersion theory of the proton Compton process are derived in a framework which optimally exploits the gauge invariance, the fixed-t analyticity and the s-u crossing properties of the scattering amplitudes, together with the consequences of the s, u-channel unitarity. The bounds, which are expressed only in terms of measurable s, u-channel physical quantities, without any reference to model dependent annihilation channel contributions, appear to be quite restrictive for some values of the momentum transfer t. The results are significant for removing the sign ambiguity of the pion decay constant. Fsub(p) and for the estimation of the electromagnetic polarizabilities of the proton.

46896 **(IFIN-HE—106-1982) New method of phase shift analysis by using the Pade approximants.** Cupsa, O.; Nichitiu, F. (Institutul Central de Fizica, Bucharest (Romania)). Nov 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702821.

In this paper it is shown that the Pade approximant of the second type (P.A.II) can improve the rate of convergence of a Legendre convergent series. Expanding the P.A.II in a Legendre series, one can recover the coefficients of the original series to a high orbital momentum value. Approximating the scattering amplitude with a P.A.II ansatz and a limited number of parameters one pay obtain information about higher partial waves by expanding the P.A.II. The method is extended to spin 0 on spin 1/2 scattering (exemples are shown for πN phase shift analysis) using the P.A.II for the scattering amplitude in the Barrelet formalism.

46897 **(IFVE-OTF—83-23) Scaling violation in charmed meson inclusive production.** Kartvelishvili, V.G.; Likhoded, A.K.; Slabospitsky, S.R. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1983. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702822.

The scaling violation of the fragmentation function of charmed c-quark into D-meson is calculated in the framework of the leading logarithmic approximation of QCD for the reactions $e^+e^- \to D^* + X$, $\sqrt{s} = 29$ GeV. The production of beauty B-mesons and their further decays into D-meson are also considered. The variation of the fragmentation function at the scaling variable $z >$ or approximately 0.6 is shown to be caused by the scaling violation, but at $z <$ or approximately 0.6 this effect is shadowed by the essential contribution from the B-meson production.

46898 **(ITEP—93(1983)) Quark compound bag (QCB) model and nucleon-nucleon interaction.** Simonov, Yu.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. 67p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84702859.

Quark degrees of freedom are treated in the NN system in the framework of the QCB model. The resulting QCB potential is in agreement with experimental data. P-matrix analysis inherent to the QCB model is discussed in detail. Applications of the QCB model are given including the weak NN interaction.

46899 **(KFTI—82-37) Correlation of the elastic pion production processes at the lepton-nucleus interaction.** Rekalo, M.P. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702816.

Using the isotopic structure of electromagnetic, charged and neutral weak currents of hadrons, a whole series of correlations between different contributions in the differential cross section of processes $e^{-+} + {}^4He \to e^{-+} + \pi^0 + {}^4He$, $\nu(\text{anti } \nu) + {}^4He \to \nu(\text{anti } \nu) + \pi^0 + {}^4He$ and $\nu(\text{anti } \nu) + {}^4He \to \mu^-(\mu^+) + \pi^+(\pi^-) + {}^4He$ (with registration of 2 particles in the final state) is obtained. ^{4}He nucleus is considered, in this case, as an elementary particle with quite definite values of the spin and isotopic spin. It is shown that p-odd effects in $e^{+-} + {}^4He \to e^{+-} + p^0 + {}^4He$ processes are determined by different characteristics of neutrino processes of pion production on ^{4}He nuclei due to weak neutral currents.

46900 **(LA-UR—84-2505) Stochastic cell model for hadronic multiparticle distributions.** Carruthers, P.; Shih, C.C. (Los Alamos National Lab., NM (USA); Tennessee Univ., Knoxville (USA). Dept. of Physics). 1984. Contract W-7405-ENG-36. 11p. (CONF-8406183—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016480.

From 15. international symposium on multiparticle dynamics; Lund, Sweden (11 Jun 1984).

Hadronic multiplicity distributions, KNO scaling and deviations therefrom are examined in a fairly general framework with emphasis on the negative binomial distribution. 19 references.

46901 **(TRI-PP—83-8) Two-body form factors at high Q^2.** Gross, F.; Keister, B.D. (TRIUMF, Vancouver, British Columbia (Canada)). Feb 1983. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702817.

The charge form factor of a scalar deuteron at high momentum transfer is examined in a model employing scalar nucleons and mesons. With an eye toward establishing consistency criteria for more realistic calculations, several aspects of the model are examined in detail: the role of nucleon and meson singularities in the one-loop impulse diagram, the role of positive-and negative-energy nucleons, and the relationship to time-ordered perturbation theory. It is found that at large Q^2 (1) the form factor is dominated by a term in which the spectator nucleon is on the mass shell, and (2) the meson singularity structure of the d-n-p vertex function is unimportant in determining the overall high-Q^2 behaviour of the form factor.

46902 **(TRI-PP—83-9) Jets and quark fragmentations in Higgs boson decays.** Kalyniak, P.; Ng, J.N. (TRIUMF, Vancouver, British Columbia (Canada)). Feb 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702818.

We have calculated the first order QCD to the rate of the Higgs boson decaying into two heavy quarks. Our corrections are found to be numerically smaller than previously obtained. By constructing a hybrid heavy quark fragmentation model we calculated the average momentum fraction carried off by rank one and two mesons in the decay. We also found that the average charge multiplicity from Higgs boson decay is high and is estimated to be approximately 17 charged particles for a Higgs with mass of 20 GeV/c^2.

46903 **(TRI-PP—83-12) Implications of the non-uniqueness in the solution of the gauge indentities for the Schwinger-Dyson equation.** Jennings, B.K.; Woloshyn, R.M. (TRIUMF, Vancouver, British Columbia (Canada)). Feb 1983. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702824.

It is shown that the Slavnov-Taylor identity does not put enough constraint on the longitudinal vertex function to allow the unambiguous construction of an approximate Schwinger-Dyson equation for the gluon propagator.

46904 **Electric charge of the magnetic monopole.** Niemi, A.J.; Paranjape, M.B.; Semenoff, G.W. (The Institute for Advanced Study, Princeton, New Jersey 08540). *Physical Review Letters;* **53**: No. 6, 515-518(6 Aug 1984). Contract AC02-76ER02220.

The electric charge of a generic SU(2) magnetic monopole is investigated in field-theory models with fermions. The fermionic contribution to the charge is computed by a comparison with Gauss's law and its dependence on the fermion representation is revealed. A disagreement with the results obtained from the bosonization procedure is pointed out and related to a difficulty in fixing the homogeneous solution of Gauss's law.

46905 **Possible signature for production of majorana particles in e^+-e^- and p-anti p collisions.** Petcov, S.T. (Inst. po Yadrena Fizika i Yadrena Energetika, Sofia, USSR). *Physics Letters,* [*Section*] *B;* **139**: No. 5/6, 421-426(24 May 1984).

It is shown that the forward-backward asymmetry in the production of Majorana particles in e^+-e^- and p-anti p collisions is identically equal to zero if the couplings generating the process conserve the CP-parity, and that the asymmetry vanishes to leading order in perturbation theory if the production mechanism is perturbative and the S-matrix is CPT-invariant. In the case of p-anti p interactions the second statement is proved assuming that the strong interactions are described by QCD and that the relevant subprocesses involve in the leading approximation two particles (quarks, gluons or a quark and a gluon) in the initial state. The absence of forward-backward asymmetry is one possible signature for production of Majorana particles (other than light neutrinos) in e^+-e^- and p-anti p collisions at high energies.

46906 **Covariant polarization bases for spin=1/2, 1, 3/2 particles and their use.** Passarino, G. (Stanford Linear Accelerator Center, CA). *Nuclear Physics* [*Section*] *B;* **237**: No. 2, 249-273(14 May 1984).

A simple method is presented for evaluating transition amplitudes between massive states with spin=1/2, 1 and definite polarization. The spin-3/2 case is also briefly discussed. Applications to testing the decay and production of vector bosons are considered.

46907 **Heavy flavors in four-body Z^0 decay.** Axelrod, A. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review* [*Section*] *D: Particles and Fields;* **29**: No. 9, 2027-2037(1 May 1984). Contract W-31-109-ENG-38.

Four-body decay of the Z^0 into one heavy fermion (M/sub h/> or =50 GeV) and three light fermions has been calculated at O(α/sub W/ ³) in the SU(2)/sub L/ x U(1) theory. The expression for the decay rate was derived and numerical integration over the phase space was performed. The heavy fermion was taken to be the top quark or any of the hypothetical fourth-generation quarks and leptons. For heavy-fermion mass M/sub h/<M/sub W/, the approximation of real-intermediate-W production and subsequent decay was good to only about a factor of 2.5. All branching ratios are at most $\sim 10^{-7}$ (times a possibly small Kobayashi-Maskawa factor in the fourth-generation case), and decrease with increasing M/sub h/.

46908 **Nucleon-antinucleon interaction.** Dover, C.B. (Brookhaven National Lab., Upton, NY (USA)). *Nuclear Physics* [*Section*] *A;* **416**: 313c-334c(26 Mar 1984). (CONF-830862—).

From 10. international conference on few-body problems in physics; Karlsruhe, F.R. Germany (21 Aug 1983).

The current status of our understanding of the low energy nucleon-antinucleon (Nanti N) interaction is reviewed. We compare several phenomenological models which fit the available Nanti N cross section data. The more realistic of these models employ an annihilation potential W(r) which is spin, isospin and energy dependent. The microscopic origins for these dependences are discussed in terms of quark rearrangement and annihilation processes. It is argued that the study of Nanti N annihilation offers a powerful means of studying quark dynamics at short distances. We also discuss how one may try to isolate coherent meson exchange contributions to the medium and long range part of the Nanti N potential. These pieces of the Nanti N interaction are calculable via the G-parity transformation from a model for the NN potential; their effects are predicted to be seen in Nanti N spin observables, to be measured at LEAR. The possible existence of quasi-stable bound states or resonances of an anti N plus one or more nucleons is discussed, with emphasis on few-body systems. 42 refs.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 64530046917, 46919, 46942

46909 **Parity conservation in quantum chromodynamics.** Vafa, C.; Witten, E. (Joseph Henry Laboratories, Princeton University, Princeton, New Jersey 08544). *Physical Review Letters;* **53**: No. 6, 535-536(6 Aug 1984). Contract AC02-76ER02220.

We show that in parity-conserving vectorlike theories such as QCD, parity conservation is not spontaneously broken.

46910 **Gauge-boson masses and mixings in left-right—symmetric models.** Masso, E. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review Letters;* **52**: No. 22, 1956-1959(28 May 1984). Contract AC03-76SF00515.

This paper reports a study of SU(2)/sub L/xSU(2)/sub r/ xU(1)/sub B/-L gauge models with a completely general Higgs sector. The scalars which are consistent with the known low-energy phenomenology are determined. The results are used to obtain useful constraints on the W/sub L/-W/sub R/ mixing angle, ξ. In particular, the stringent upper limit ξ< or =0.002 is derived.

6454 Field Theory

REFER ALSO TO CITATION(S) 64540046904, 46906, 46909

46911 **(NBI-HE—84-03) Recoil of the pion-surrounded nucleon bag and axial form factors.** Klabucar, D.; Picek, I. (Niels Bohr Inst., Copenhagen (Denmark)). Mar 1984. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702823.

A recent method of boosting the bag is extended to the pion-surrounded nucleon bag and developed for the calculation of low-energy nucleon form factors. The usefulness of the method is illustrated by the induced pseudoscalar form factor where both the inclusion of the pion field and the non-vanishing momentum transfer are necessary.

46912 **Superspace approach to lattice supersymmetry.** Kostelecky, V.A.; Rabin, J.M. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Mathematical Physics (New York);* **25**: No. 9, 2744-2748(Sep 1984).

We construct a cubic lattice of discrete points in superspace, as well as a discrete subgroup of the supersymmetry group which maps this "superlattice" into itself. We discuss the connection between this structure and previous versions of lattice supersymmetry. Our approach clarifies the mathematical problems of formulating supersymmetric lattice field theories and suggests new methods for attacking them.

46913 **Microcanonical renormalization group.** Creutz, M.; Gocksch, A.; Ogilvie, M.; Okawa, M. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **53**: No. 9, 875-877(27 Aug 1984). Contract AC02-76CH00016.

We argue that microcanonical Monte Carlo techniques can provide direct information on the values of renormalized coupling constants in numerical renormalization-group studies. The method is tested on SU(2) lattice gauge theory with fundamental and adjoint couplings and on the two-dimensional O(3) Heisenberg model.

46914 **Topology in strong coupling.** Seiberg, N. (The Institute for Advanced Study, Princeton, New Jersey 08540). *Physical Review Letters;* **53**: No. 7, 637-640(13 Aug 1984). Contract AC02-76ER02220.

The lattice CP/sup N/-1 model at nonzero θ is analyzed by a strong-coupling expansion. At $\theta = \pi$, CP is spontaneously broken and the theory ceases to confine. The θ dependence of several quantities is computed and the correlation length is shown to increase with θ. Most of the results apply not only to the CP/sup N/-1 model (for all values of N) but to other two-dimensional nonlinear σ models as well.

46915 **Scaling and θ dependence in the O(3) σ model.** Bhanot, G.; Dashen, R.; Seiberg, N.; Levine, H. (The Institute for Advanced Study, Princeton, New Jersey 08540). *Physical Review Letters;* **53**: No. 6, 519-522(6 Aug 1984). Contract AC02-76ER02220.

We use Monte Carlo simulations to examine the θ dependence of the O(3) σ model. The free energy as a function of θ is determined and its peculiar scaling properties are clarified.

46916 **Fermion determinants, chiral symmetry and the Wess-Zumino anomaly.** Alvarez, O. (Lawrence Berkeley Lab., CA). *Nuclear Physics* [*Section*] *B;* **238**: No. 1, 61-72(28 May 1984).

A general method for constructing exactly solvable fermion determinants is discussed. A two-dimensional determinant is solved exactly. A new class of four-dimensional fermion models is presented. These theories are non-renormalizable yet the fermion determinant can be calculated and there is an analogue of the Adler-Bell-Jackiw anomaly.

46917 **Riemann-Hilbert transforms and Bianchi-Baaumlcklund transformations for the supersymmetric Yang-Mills fields.** Chau, L.; Mo-Lin, G.; Popowicz, Z. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **52**: No. 22, 1940-1943(28 May 1984). Contract AC02-76CH00016.

Riemann-Hilbert transforms, and their connections with the affine Lie algebra of Kac and Moody, and a two-parameter Bianchi-Baaumlcklund transformation are given for the constraint equations for the supersymmetric Yang-Mills fields. These are important integrable properties of the supersymmetric Yang-Mills fields; especially for N> or =3 these constraint equations give equations of motion of the fields.

46918 **Finite-size core effects in the Callan-Rubakov model.** Goldstein, W.; Soldate, M. (Stanford Linear Accelerator Center, CA). *Physics Letters,* [*Section*] *B;* **139**: No. 5/6, 382-388(24 May 1984).

The interaction of the J=0 partial wave of a massless isodoubled Dirac fermion with an SU(2) gauge theory monopole of finite size is investigated by studying the original model of Callan and Rubakov with boundary conditions imposed at a core radius r_0 not= 0. Both the chirality non-conserving and gauge-invariant 'charged' condensates are studied with special attention to their leading dependence on r_0 and α identical $e^3/4\pi$. It is found that, at fixed $r > r_0 > 0$, the $\alpha \to 0$ limit reproduces the free field values of both condensates, in contrast to the limit obtained with $r_0=0$. For finite α, however, the leading core effects are negligible for $r >> r_0/\alpha$. A gauge dependent, charge-carrying condensate is also considered and shown to vanish.

46919 **Monte Carlo study of SU(4) gauge theory at finite temperature.** Gocksch, A.; Okawa, M. (Department of Physics, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **52**: No. 20, 1751-1754(14 May 1984). Contract AC02-76CH00016.

The pure SU(4) Yang-Mills theory is studied at finite temperature. We observe a first-order transition at 8/g/sub c/^{2} = 10.50 +- 0.02.

46920 **Simple N=1 supergravity GUT.** Ovrut, B.A.; Raby, S. (Rockefeller Univ., New York). *Physics Letters,* [*Section*] *B;* **138**: No. 1-3, 72-76(12 Apr 1984).

We present a simple supergravimetry GUT in which supersymmetry is spontaneously broken without introducing an O 'Raifeartaigh or Polonyi sector. The theory naturally predicts a long nucleon lifetime, and light SU(3) octet and SU(2) triplet superfields. The SU(2) X U(1) symmetry breaking is induced by radiative corrections.

46921 **Lepton number violation in softly broken supersymmetry.** Lee, I.H. (Lawrence Berkeley Lab., CA). *Physics Letters,* [*Section*] *B;* **138**: No. 1-3, 121-127(12 Apr 1984).

We study the implications of explicit lepton number violating soft operators in a general low-energy effective theory with softly broken supersymmetry. We find that nonzero but relatively small VEVs of scalar neutrinos could exist. In the case where the VEVs of scalar neutrinos vanish, the lepton number violating effects are naturally suppressed.

46922 **Quantum chromodynamics in few nucleon systems.** Brodsky, S.J. (Stanford Linear Accelerator Center, CA (USA)). *Nuclear Physics* [*Section*] *A;* **416**: 3c-24c(26 Mar 1984). (CONF-830862—). Contract AC03-76SF00515.

From 10. international conference on few-body problems in physics; Karlsruhe, F.R. Germany (21 Aug 1983).

After a general introduction to quantum chromodynamics the author describes the application of QCD to exclusive hadronic processes. Then the deuteron is considered in a QCD framework. Thereafter reduced nuclear scattering amplitudes are discussed. Finally, the limitations of traditional nuclear physics due to QCD are considered. 32 refs.

6455 Scattering Theory

46923 **Elementary approach to scattering theory.** Haller, K. (Department of Physics, University of Connecticut, Storrs, Connecticut 06268). *American Journal of Physics;* **52**: No. 9, 804-807(Sep 1984). Contract AC02-79ER10336.

Expressions for the time-dependent scattering wave function, S-matrix elements, and the transition rate are derived using simple time-dependent perturbation theory as it is presented in elementary quantum-mechanics texts.

65 PHYSICS. II.

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 65100046267

46924 **(BNL-NCS—51800) Nuclear structure references coding manual.** Ramavataram, S.; Dunford, C.L. (National Nuclear Data Center, Upton, NY (USA)). Feb 1984. Contract AC02-76CH00016. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017170.

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This manual is intended as a guide to Nuclear Structure References (NSR) compilers. The basic conventions followed at the National Nuclear Data Center (NNDC), which are compatible with the maintenance and updating of and retrieval from the Nuclear Structure References (NSR) file, are outlined. The structure of the NSR file such as the valid record identifiers, record contents, text fields as well as the major topics for which [KEYWORDS] are

prepared are ennumerated. Relevant comments regarding a new entry into the NSR file, assignment of [KEYNO], generation of [SELECTRS] and linkage characteristics are also given. A brief definition of the Keyword abstract is given followed by specific examples; for each TOPIC, the criteria for inclusion of an article as an entry into the NSR file as well as coding procedures are described. Authors submitting articles to Journals which require Keyword abstracts should follow the illustrations. The scope of the literature covered at NNDC, the categorization into Primary and Secondary sources, etc. is discussed. Useful information regarding permitted character sets, recommended abbreviations, etc. is given.

46925 **(DOE/ER/02853—22) Nuclear structure studies by the scattering of medium-energy electrons. Progress report, September 1, 1983-August 31, 1984.** Peterson, G.A.; Hicks, R.S. (Massachusetts Univ., Amherst (USA). Dept. of Physics and Astronomy). Aug 1984. Contract AC02-76ER02853. 36p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017448.

During the past year the University of Massachusetts has actively pursued a program of electron scattering studies at the MIT - William F. Bates Linear Accelerator. In addition, a commitment has been made to collaborate with the American University Group in a major experiment at the Stanford Linear Accelerator Center. The experimental work at Bates, the work to commence at SLAC, and the theoretical work are described. Experiments include transverse quasielastic scattering on ^{56}Fe, a search for discrete resonances in the continuum of ^{4}He, high momentum transfer (q) studies of elastic magnetic scattering from ^{7}Li, ^{10}B, ^{13}C, and ^{14}N, and high resolution scattering from ^{26}Mg. Publications and nuclear seminars and colloquia given at the University of Massachusetts are listed. (WHK)

46926 **(DOE/ER/03496—79) Studies of heavy ion reactions and transuranic nuclei. Progress report, August 1, 1983-August 31, 1984.** Huizenga, J.R.; Schroeder, W.U. (Rochester Univ., NY (USA). Dept. of Chemistry and Physics). Aug 1984. Contract AC02-76ER03496. 492p. (COO—3496-79). NTIS, PC A21/MF A01; 1; GPO Dep. File Number DE84016629.

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The status of the current understanding of the microscopic mechanisms operating in damped nuclear reactions is reviewed. Several experimental and conceptual problems of attempts to determine the nuclear interaction potential for distances inside the fusion barrier are discussed. An explanation of the unexpectedly large angular anisotropies of fragments from fission of heavy systems produced at large spins has been found in terms of the statistical scission model. In this model, the phase space available to the final deformed fission fragments governs the fission probability. Processes associated with incomplete linear-momentum transfer have been studied for 292-MeV ^{20}Ne-induced fission with targets of ^{165}Ho, ^{181}Ta, ^{197}Au, ^{209}Bi, and ^{238}U. Preequilibrium neutron emission has been studied in central and peripheral ^{165}Ho + ^{20}Ne and ^{165}Ho + ^{12}C collisions at bombarding energies between 11 and 25 MeV/nucleon. In preparation of kinematically complete coincidence experiments, a fast, position-sensitive avalanche detector with a large active area has been developed. The theoretical framework of the statistical scission model for fission has been reconsidered. Exclusive measurements were made of alpha particles emitted in the damped reaction ^{165}Ho + ^{56}Fe at E/sub Lab/ = 465 MeV. The data were interpreted with the aid of rather detailed Monte Carlo evaporation simulations. As part of an extensive coincidence study of equilibration mechanisms in damped reactions, inclusive measurements of projectile-like and fusion-fission-like fragments have been performed for the ^{197}Au + ^{51}V system at E/sub Lab/ = 447 MeV. The damped reaction features have been interpreted in terms of phenomenological reaction models. (WHK)

46927 **(DOE/ER/04215—T2) Nuclear structure studies at intermediate energies. Annual progress report, October 1983-August 1984.** Hintz, N.M. (Minnesota Univ., Minneapolis (USA)). 1984. Contract AC02-77ER04215. 140p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84017427.

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The major areas of interest in our experimental and theoretical programs are as follows: (1) The determination of neutron ground state and transition densities in nuclei by comparison of proton and electron scattering, or by a π^+ - π^- comparison. (2) The study of high spin, stretched configuration, particle-hole states in nuclei by proton and electron scattering and the (p,t) reaction. (3) The determination of isoscalar multipole moments (λ up to 6 or 8) in heavy deformed nuclei by proton scattering, especially in shape transition regions. (4) Measurements of a complete set of N-N spin observables with polarized proton beams and polarized hydrogen (H,D) targets, especially at small angles in the Coulomb-nuclear interference region. (5) Development of 0° and small angle inelastic cross section measurement capabilities at the HRS to study E(0), M(1) and M(2) excitations in nuclei. Also the development of zero degree spin flip measurement capability. (6) Development of theoretical analysis programs for hadron (p, π, K, anti p) nucleus scattering and charge exchange. We are particularly interested in comparing results from various probes (electron and hadronic) to reveal inconsistencies in the theory, and to extract separate neutron and proton ground state and transition densities. (7) The study of Δ-excitation modes in nuclei by multi-particle transfer experiments. (8) Measurements to test recently developed Dirac relativistic models for proton inelastic scattering at intermediate energies. A brief summary of activities for the past year is given.

46928 **(DOE/ER/40027—T1) UCLA intermediate energy nuclear physics and relativistic heavy ion physics. Annual report, February 1, 1983-January 31, 1984.** (California Univ., Los Angeles (USA). Dept. of Physics). 1984. Contract AT03-81ER40027. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84010260.

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In this contract year the UCLA Intermediate Energy Group has continued to pursue a general set of problems in intermediate energy physics using new research tools and theoretical insights. Our program to study N-N scattering and proton-light nucleus scattering has been enhanced by a new polarized target facility (both hydrogen and deuterium) at the High Resolution Spectrometer (HRS) of the Los Alamos Meson Physics Facility (LAMPF). This facility has been constructed by our group in collaboration with physicists from KEK, LAMPF and the University of Minnesota; and the first set of experiments studying polarized beam-polarized target scattering at the HRS were completed this summer and early fall. The HRS mode of operation has led to some unique design features which are described. At the Bevalac, a new beam line spectrometer will be constructed for us during this year and next to significantly enhance our capability to study subthreshold k^+, k^- and anti p production in relativistic heavy ion collisions and to search for fractionally charged particles. During this period a proposal is being prepared for a very large acceptance spectrometer and its associated beam line which will be used to detect dilepton pairs produced in relativistic heavy ion collisions. In concert with these experimental projects, theoretical advances in the understanding of new data from the HRS, particularly spin transfer data, have been made by the UCLA group and are described. (WHK)

46929 **(INDC—39/U) Minutes of the thirteenth INDC meeting, Rio de Janeiro, 16-20 May 1983.** Rowlands, J.L. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jan 1984. 10p. (CONF-830586—Summ.). NTIS (US Sales Only), PC A06/MF A01. File Number DE84702880.

From 13. international nuclear data committee meeting; Rio de Janeiro, Brazil (16 May 1983).

The Thirteenth Meeting of the INDC was held in Rio de Janeiro from 16-20 May 1983. This was the first meeting of the Committee in its three year period 1983/85. The meeting was attended by 12 Committee members and one alternate member (members from the Federal Republic of Germany and the USA excused) plus four advisers and five observers from 13 Member States and two international organizations. The Committee reviewed the nuclear data activities of the IAEA, in Member States and of the nuclear data centre networks during the 1 year period since its Twelfth Meeting in Vienna in October 1981. It also gave detailed advice on the Agency's future nuclear data programme until 1985/86. The Committee congratulated the IAEA Nuclear Data Section (NDS)

for its excellent work and for following closely the recommendations of INDC. The minutes include summaries of the meeting discussions, full reports of the Subcommittees, lists of actions, participants and subcommittee membership.

46930 **(INDC(CCP)—210/L) Yields of radioactive nuclides formed by bombardment of a thick target with 22-MeV deuterons.** Dmitriev, P.P.; Krasnov, N.N.; Molin, G.A. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Oct 1983. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702887.

Experimental results on the radionuclide yields from the bombardment of thick targets with 22-MeV deuterons are presented. Altogether, 208 yield values were measured for 151 radionuclides. The radionuclide formation reactions are given. This work was carried out in the cyclotron of the Institute of Physics and Power Engineering.

46931 **(JAERI-M—84-052) Graphs of evaluated neutron cross sections in JENDL-2.** Asami, Tetsuo; Narita, Tsutomu (eds.). (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Japanese Nuclear Data Committee). Mar 1984. 241p. (NEANDC(J)—98/AU; INDC(JPN)—85/GL). Information Section, Div. of Technical Information, JAERI, Tokai-mura, Naka-gun, Ibaraki-ken 319-11, Japan. File Number TI84901546.

Graphs of JENDL-2 Evaluated Neutron Cross-Section Data for 89 nuclides are presented. Total, elastic and inelastic scattering, capture, fission and threshold reaction cross sections are given for each nuclide in the energy range up to 20 MeV.

46932 **(JAERI-M—84-103) Summary of JENDL-2 general purpose file.** Nakagawa, Tsuneo (ed.). (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jun 1984. 385p. (NEANDC(J)—99/AU; INDC(JPN)—86/GL). Information Section, Div. of Technical Information, JAERI, Tokai-mura, Naka-gun, Ibaraki-ken 319-11, Japan. File Number TI84901548.

The general purpose file of the second version of Japanese Evaluated Nuclear Data Library (JENDL-2) was released in December 1982. Recently, descriptive data were added to JENDL-2 and at the same time the first revision of numerical data was performed. JENDL-2 (Rev.1) consists of the data for 89 nuclides and about 211,000 records in the ENDF/B-IV format. In this report, full listings of presently added descriptive data are given to summarize the JENDL-2 general purpose file. The 2200-m/sec and 14-MeV cross sections, resonance integrals, Maxwellian and fission spectrum averaged cross sections are given in a table. Average cross sections were also calculated in suitable energy intervals.

46933 **Recent references January through April 1984.** Ramavataram, S. (Brookhaven National Laboratory, Upton, New York 11973). *Nuclear Data Sheets;* **41**: No. 1, 1-110(Jan 1984). Contract AC02-76CH00016;AC05-84OR21400.

References and keywords are given for literature received by the National Nuclear Data Center or assigned key numbers between January and April 1984.(AIP)

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 65110046979

46934 **(CONF-8304191—1-App.6) Intermediate energy spin physics. Appendix 6.** Igo, G. (California Univ., Los Angeles (USA)). 1983. Contract AT03-81ER40027. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016624.

From International school of nuclear physics; Erice, Italy (6 Apr 1983).

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Topics include nuclear information from proton spin observables in elastic scattering, nuclear information from proton spin observables in inelastic scattering, recent measurements at the HRS utilizing a focal plane polarimeter, proton spin observables in natural parity transitions, and proton spin transfer observables in unnatural parity transitions. 47 references.

46935 **(LA-UR—84-2711) Fast neutron capture with a white neutron source.** Wender, S.A.; Auchampaugh, G.F. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 11p. (CONF-840906—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016799.

From Capture gamma-ray spectroscopy conference; Knoxville, TN, USA (10 Sep 1984).

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A system has been developed at the Los Alamos National Laboratory to measure gamma-rays following fast neutron reactions. The neutron beam is produced by bombarding a thick tantalum target with the 800 MeV proton beam from the LAMPF accelerator. Incident neutron energies, from 1 to over 200 MeV, are determined by their times of flight over a 7.6-m flight path. The gamma-rays are detected in five 7.6 x 7.6-cm cylindrical bismuth germanate (BGO) detectors which span an angular range from 45° to 145° in the reaction plane. With this system it is possible to simultaneously measure the cross section and angular distribution of gamma-rays as a function of neutron energy. The results for the cross section of the $^{13}C(n,n'\gamma=4.44$ MeV) reaction at 90° and 125° show good agreement with previous measurements while the complete angular distributions show the need for a large a_4 coefficient which was not previously observed. Preliminary results for the $^{13}C(n,n'\gamma=15.1$ MeV) reaction have also been obtained. The data obtained for the $^{40}Ca(n,\gamma_0)$ reaction in the region of the giant dipole resonance demonstrate the unique capabilities of this system. Future developments to the neutron source which will enhance the capabilities of the system are presented. 14 references.

46936 **(UCRL—91455) Performing (p vector,n), (d vector,n) and (n vector,n) measurements with a rotating magnet beam swinger.** Dietrich, F.S.; Clegg, T.B. (Lawrence Livermore National Lab., CA (USA); North Carolina Univ., Chapel Hill (USA); Triangle Universities Nuclear Lab., Durham, NC (USA)). Aug 1984. Contract W-7405-ENG-48. 3p. (CONF-840945—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE84017003.

From Topical conference on neutron-nucleus collisions--a probe of nuclear structure; Glouster, OH, USA (5 Sep 1984).

Polarized beams of protons and deuterons may be used with a rotating-magnet beam swinger if a spin-precession solenoid is added before the swinger to precess the incoming spin axis.

6512 Nuclear Properties And Reactions, A=1-5

REFER ALSO TO CITATION(S) 65121047021, 47021

46937 **(ITEP—17(1983)) Hilbert-Schmidt method for nucleon-deuteron scattering.** Moeller, K.; Narodetskij, I.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. 35p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702836.

The Hilbert-Schmidt technique is used for computing the divergent multiple-scattering series for scattering of nucleons by deuterons at energies above the deuteron breakup. It is found that for each partial amplitude a series of s-channel resonances diverges because of the logarithmic singularities which reflect the t-channel singularities of the total amplitude. However, the convergence of the Hilbert-Schmidt series may be improved by iterating the Faddeev equations thereby extracting the most strong logarithmic singularities. It is shown that the series for the amplitudes with first two iterations subtracted converges rapidly. Final results are in excellent agreement with exact results obtained by a direct matrix technique.

46938 **(JINR—1-83-566) Total disintegration of ^{4}He nucleus in the ^{4}Hep → ppppnπ$^-$.** Zielinski, P.; Stepaniak, J.; Glagolev, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702877.

The correlation of nucleon pairs in the ^{4}Hep → ppppnπsup(-) reaction is analyzed over their relative azimuthal angles. The experiment has been realised on the JINR LHE synchrophasotron by

means of the 1 m hydrogen bubble chamber. It has been found that mainly two or three nucleons of the ^{4}He nucleons take part in the studied reactions. The events may be divided into two groups, those with the rescattering of the leading nucleon and with the interaction of secondary fragments. Some irregularities have been observed in the two-proton effective mass distribution, one at (2036+-15) MeV/c^2 and the second at (2126+-15) MeV/c^2.

46939 (JINR—R-4-83-279) Analytical folding potentials and heavy ion interaction. Burov, V.V.; Knyaz'kov, O.M.; Shirokova, A.A.; Shitikova, K.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702860.

Within the analytic folding model analytic expressions are found for potentials in the system of interacting heavy ions. A simple parametrization is proposed for the distribution densities of matter in light nuclei calculated in the hyperspherical-function method. The potentials are calculated numerically with the use of finite-range effective forces for the systems ^{4}He+^{4}He, ^{4}He+^{6}Li, ^{4}He+^{12}C, ^{4}He+^{16}O, ^{6}Li+^{6}Li, ^{6}Li+^{12}C, ^{6}Li+^{16}O, ^{12}C+^{12}C, ^{12}C+^{16}O, ^{16}O+^{16}O. The results are compared with those obtained on the basis of the Skyrme interaction. Angular distributions are calculated for the 139 MeV α-particles elastic-scattered by ^{12}C nucleus and compared with the experimental cross section.

46940 (JINR—R-4-83-547) Density approximation of ground and excited states of light nuclei. Bogdanova, N.; Shirokova, A.A.; Shitikova, K.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702848.

For constructing the potential of heavy ion collisions with finite-range forces the nuclear matter distributions obtained in the method of hyperspherical functions are approximated. Different algo rithms of nuclear matter approximation are proposed which are calculated by the least-square fit. The density parameters for ground and excited states of ^{4}He, ^{6}Li, ^{12}C and ^{16}O nuclei are found. These may be used for calculation of elastic and inelastic form factors of electron scattering, nuclear potentials of heavy ion collisions.

46941 (LA—10174-T) Elastic scattering of polarized protons on deuterium at 800 MeV. Weston, G.S. (Los Alamos National Lab., NM (USA)). Jul 1984. Contract W-7405-ENG-36. 188p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE84017074.

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A specific set of spin transfer coefficients has been measured for proton-deuteron elastic scattering at 800 MeV using an unpolarized liquid deuterium target. The experiment was done using the High Resolution Spectrometer (HRS) at the Los Alamos Meson Physics Facility (LAMPF) with a polarized proton beam. The scattered proton spin direction was determined using the Focal Plane Polarimeter (FPP) of the HRS, which employs a carbon analyzer. Some of the spin dependent parameters measured in this experiment are of considerable interest because they provide selective information about the nucleon-nucleon (NN) amplitude. Since the deuteron is the simplest bound nucleus, pd elastic scattering is particularly well suited for testing multiple scattering theories. These measurements will also be used to eventually determine the full pd collision matrix, which contains all possible information about the scattering process. In addition, the experimental setup is described for a polarized proton-polarized deuterium target spin transfer experiment also done at the HRS at 800 MeV incident proton energy. 71 references.

46942 (LA-UR—84-2480) Parity nonconservation in light hadronic systems. Mischke, R.E. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 11p. (CONF-840789—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016484.

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Parity-nonconservation experiments in light hadronic systems now provide a fairly consistent picture of the important weak coupling constants. One cause for concern is the ^{18}F system, which gives a limit that is becoming significantly small compared to the prediction. New results and some details of the experiments using 800 MeV polarized protons are given. 53 references.

46943 (LA-UR—84-2481) Parity nonconservation in proton-proton and proton-water scattering at 1.5 GeV/c. Mischke, R.E.; Bowman, J.D.; Carlini, R.; MacArthur, D.; Nagle, D.E.; Frauenfelder, H.; Harper, R.W.; Yuan, V.; McDonald, A.B.; Talaga, R.L. (Los Alamos National Lab., NM (USA); Illinois Univ., Urbana (USA); Princeton Univ., NJ (USA); Maryland Univ., College Park (USA)). Jul 1984. Contract W-7405-ENG-36. 11p. (CONF-840757—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016483.

From 22. international conference on high energy physics; Leipzig, German D.R. (19 Jul 1984).

Experiments searching for parity nonconservation in the scattering of 1.5 GeV/c (800 MeV) polarized protons from an unpolarized water target and a liquid hydrogen target are described. The intensity of the incident proton beam was measured upstream and downstream of the target by a pair of ionization detectors. The beam helicity was reversed at a 30-Hz rate. Auxiliary detectors monitored beam properties that could give rise to false effects. The result for the longitudinal asymmetry from the water is A/sub L/ = (1.7 +- 3.3 +- 1.4) x 10^{-7}, where the first error is statistical and the second is an estimate of systematic effects. The hydrogen data yield a preliminary result of A/sub L/ = (1.0 +- 1.6) x 10^{-7}. The systematic errors for p-p are expected to be $< 1 \times 10^{-7}$.

46944 (TRI-PP—83-15) Electro-disintegration of ^{2}H with polarized beam and target. Cheung, C.Y.; Woloshyn, R.M. (TRIUMF, Vancouver, British Columbia (Canada)). Mar 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702863.

The asymmetry with respect to change in sign of the electron longitudinal polarization is calculated for the exclusive ^{2}H(e,e'n)p and inclusive ^{2}H(e,e')X reactions on a polarized deuteron target. The sensitivity to the neutron electric form factor is discussed.

46945 (TRI-PP—83-18) Optical model analysis of intermediate energy p-^{4}He scattering. Greben, J.M.; Gourishankar, R. (TRIUMF, Vancouver, British Columbia (Canada)). Mar 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702862.

Recent Wolfenstein R-parameter data are used to explain and resolve previous problems with optical model descriptions of p-^{4}He elastic scattering at 500 MeV. An essential component in this optical model analysis is a qualitative interpretation of different features of the elastic data in terms of the Born approximation. First we show that the R-data require the real spin-orbit potential to have certain geometrical properties which were missing in previous analyses. We can then show that the fast fall-off of the cross-section for small angles, together with the rapid increase and subsequent decrease of the polarization, establishes the need for an attractive tail in the real central potentials can also be inferred from this qualitative analysis, in particular a strong reduction of the spin-orbit potential. Our final potential gives a reduction of the X^2/datapoint by about 20 in comparison to previous potentials, and underlines the usefulness of the qualitative Born analysis.

46946 Measurement of the reaction ^{4}He(γ,π^0) ^{4}He for E/sub γ/ = 290 MeV. Tieger, D.R.; Booth, E.C.; Miller, J.P.; Roberts, B.L.; Comuzzi, J.; Dodson, G.W.; Gilad, S.; Redwine, R.P. (Department of Physics, Boston University, Boston, Massachusetts 02215). *Physical Review Letters;* **53**: No. 8, 755-758(20 Aug 1984). Contract AC02-76ER03069.

We report measurements of differential cross sections for the reaction ^{4}He(γ,π^0) ^{4}He with a photon energy of 290 MeV. Use of a good-resolution π^0 spectrometer allowed restriction of events to those where the residual ^{4}He nucleus was left in the ground state (the coherent process). By detecting the π^0 directly, we thus provide the first forward-angle data for this reaction in the Δ-resonance region. Our results are in good agreement with a recent Δ-hole model calculation.

46947 Measurement of the ground-state gamma-ray branching ratio of the dt reaction at low energies. Cecil, F.E.; Wilkinson,III, F.J. (Department of Physics, Colorado School of Mines, Golden, Colorado 80401). *Physical Review Letters;* **53**: No. 8, 767-770(20 Aug 1984). Contract AC02-83ER40091.

The branching ratio Γ/sub gamma0//Γ/sub α/ for the d+t reaction has been measured between deuteron energies of 45 and 146 keV. Pair-coincidence spectrometry and pulse-shape discrimination were employed to reduce the neutron effects in the NaI(Tl) gamma-ray detector. The branching ratio is found to be constant over the energy range of the measurements with a best value Γ/sub γ/₀/Γ/sub α/ = (5.4 +- 1.3) x 10^{-5}. This value is significantly greater than cluster-model calculations of the branching ratio.

46948 Future experiments on QCD effects in few nucleon systems with high energy electrons. Arnold, R.G. (American Univ., Washington, DC; Stanford Linear Accelerator Center, CA (USA)). *Nuclear Physics [Section] A;* **416**: 119c-128c(26 Mar 1984). (CONF-830862—). Contract AC03-76SF00515.

From 10. international conference on few-body problems in physics; Karlsruhe, F.R. Germany (21 Aug 1983).

In this talk I review some of the evidence for quarks in nuclei from previous high energy (E> 1 GeV) electron scattering experiments. 40 refs.

46949 Few body experiments with polarized beams and polarized targets. Simmons, J.E. (Los Alamos National Lab., NM (USA)). *Nuclear Physics [Section] A;* **416**: 553c-564c(26 Mar 1984). (CONF-830862—).

From 10. international conference on few-body problems in physics; Karlsruhe, F.R. Germany (21 Aug 1983).

A survey is presented concerning recent polarization experiments in the elastic p-d, p-^{3}He, and p-^{4}He systems. Mention is made of selected neutron experiments. The nominal energy range is 10 to 1000 MeV. Recent results and interpretations of the p-d system near 10 MeV are discussed. New experiments on the energy dependence of back angle p-d tensor polarization are discussed with respect to resolution of discrepancies and difficulty of theoretical interpretation. Progress is noted concerning multiple scattering interpretation of forward p-d deuteron polarization. Some new results are presented concerning the p-^{3}He system and higher energy p-^{4}He polarization experiments. 52 refs.

6513 Nuclear Properties And Reactions, A=6-19

46950 (BNL—51662) Study of strange nuclei. Chrien, R.E. (Brookhaven National Lab., Upton, NY (USA)). 8 Dec 1982. Contract AC02-76CH00016. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017195.

Brookhaven Lecture Series No. 195.

A brief history of the discovery of hypernuclei is given and some recent hypernuclei studies are described. Topics include the study of p-shell hypernuclei, ^{12}C (K^-, π^-) experiment, and hypernuclear gamma rays. 13 references. (WHK)

46951 (DOE/ER/02853—23) Studies of P-shell nuclei by large momentum transfer electron scattering. Hicks, R.S. (Massachusetts Univ., Amherst (USA). Dept. of Physics and Astronomy). 1984. Contract AC02-76ER02853. 13p. (CONF-840789—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016803.

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

The use of transverse electron scattering as a technique for studying the structure of 1p-shell nuclei is briefly reviewed. At the present time there exist unresolved problems such as missing strength in comparison with shell model calculations. At the same time, the observed cross sections fall off more slowly than expected at high momentum transfers. The derivation of phenomenological wave functions for the ground and 2.313 MeV states in ^{14}N is described. 18 references.

46952 (IFIN-HE—105-1982) Matter radius of ^{12}C and ^{16}O. Avram, A.; Nichitiu, F. (Institutul Central de Fizica, Bucharest (Romania)). Jul 1982. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702853.

In this paper we have determined the effective nuclear radius of ^{12}C and ^{16}O in the energy region of the first baryonic resonance. This parameter which describes the forward peak of πA differential cross section does not show simple linear dependence on the inverse squared CM-momentum predicted by the optical-model. A structure effect, which is more evident when A increases, can be observed around Δ_{33} energy.

46953 (ITEF—148(1983)) Cross section of 70-230 MeV proton production in the p + A → p + X reactions at 1-9 GeV/c, π^+ + A → p + X at 1-6 GeV/c and in the π^- + A → p + X at 1.4 and 5 GeV/c. Bayukov, Yu.D.; Gavrilov, V.B.; Goryainov, N.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. 99p. (In Russian). NTIS (US Sales Only), PC A05/MF A01. File Number DE84702866.

The tables of cross sections of proton production with energies 70-230 KeV for reactions p+A→p+X at 1-9 GeV/c, π^+ +A→p+X at 1-6 GeV/c and π^- +A→p+X at 1.4 and 5 GeV/c are presented. The dependences on initial particle momentum are measured (for protons at 1, 1.4, 2, 5, 6, 6.25, 6.5, 7, 7.5, 8.25, 8.5 and and 9 GeV/c, for π^+ at 1, 1.4, 2, 3, 4, 5 and 6 GeV/c and for π^- at 1.4 and 5 GeV/c) for C, Cu, Pb and U targets at the angles of 59 deg, 89 deg, 119 deg and 160 deg. At these angles A-dependence was also measured in detail (for Be, C, Al, Ti, Fe, Cu, Nb, Cd, Sn, Ta, Pb and U targets) for initial protons with 7.5 GeV/c. Detailed angular dependences at the range from 10 deg to 177 deg are presented for C, Cu, Pb and U targets for initial protons of 7.5 GeV/c and π^- mesons of 5 GeV/c.

46954 (ITF—83-100-R) Proton and deuteron scattering on the ^{6}Li nucleus in the intermediate energy range. Peresypkin, V.V. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1983. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702839.

The dependence of elastic and inelastic differential cross-section of p^{6}Li-scattering from the value of ^{6}Li mean-sguare radius is studied. The contribution of ^{6}Li nucleus virtual excitations to the elastic d^{6}Li-scatteripg is studied.

46955 (ITP—82-112-E) Multi-particle correlation effect at intermediate-energy proton scattering by ^{6}Li. Peresypkin, V.V.; Polyakov, P.L.; Krasnopol'skij, V.M.; Goryachy, V.V. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1982. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702842.

In the framework of the Glauber-Sitenko theory study is made of the elastic proton scattering by ^{6}Li at the energy of 0.6 and 1.04 GeV using the realistic phenomenological wave functions for different sets of parameters of the elastic scattering NN-amplitudes. An essential cross-sections on a form of the ^{6}Li wave function is shown.

46956 (ITP—82-149-E) Nature of some monopole resonances of p-shell nuclei. Filippov, G.F.; Vasilevsky, V.S.; Nesterov, A.V. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1982. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702843.

The resonance structure of states of a continuous spectrum of light nuclei is studied. Using ^{7}Li and ^{9}Be as an example it is shown that in these nuclei there exist a near-threshold resonance the share of which is about 50-70 % of isoscalar monopole sum rule. The experimental method of finding the near-threshold resonances is described.

46957 (JINR—D-2-82-568, pp 143-148) Study on energy and A-dependence of proton polarization knocked-out by 640 MeV protons from nuclei. Zul'karneev, R.Ya.; Kutuev, R.Kh. 1982. (In Russian). NTIS (US Sales Only), PC A09/MF A01. File Number TI84780158. (CONF-8205252—).

From Meeting on investigations in the field of relativistic nuclear physics; Dubna, USSR (25 May 1982).

Detail data on the polarization dependence on cumulative proton momentum and the mass number of a nucleus-target are stated. Incident proton energy is 640 MeV. The particle separation was performed according to the time-of-flight and energy absorbed with a NaI large crystal. Analysis of the proton spin state was carried out by the method of their repeated scattering at 12 deg +- 1 deg angle with a carbon target having known analyzing properties. Inclusive proton polarization was measured at 5 angles (from 58 deg to 150 deg l.s.) with the carbon target and at angles of 90 and 130 deg for Be, Al and Pb nuclei. The proton polarization dependence on the atomic number A of the nucleus-target decreases monotonously with the A growth. Data on the inclusive proton polarization obtained in the precumulative energy range do not contradict predictions based on the model considerations for the area of limiting nucleus fragmentation. However, to draw a finite conclusion, it is necessary to continue measurements at higher energies at higher statistical accuracies.

46958 (JINR—D-2-82-568, pp 166-169) **Study on Λ hyperon production in beams of relativistic nuclei and polarized deuterons.** Okonov, Eh.O. 1982. (In Russian). NTIS (US Sales Only), PC A09/MF A01. File Number TI84780158. (CONF-8205252—).

From Meeting on investigations in the field of relativistic nuclear physics; Dubna, USSR (25 May 1982).

Results obtained with SKM-200 were used to compare basic characteristics of the Λ(k^0) particle production during central interactions (CI) of $^{12}C+Ne(^{12}C+^{12}C)$ nuclei at 3.67 GeV/A with corresponding data for inelastic $^4He^6Li$ interactions for which nucleon-nUcleon interactions are determining. Ratio of the (k^0) particle yield to the π^- meson yield for CNe interactions is higher than for ^4HeLi interactions, however, this exceeding is beyond the error limits. Λ hyperon polarization evaluation for CI of ^{12}CNe and $^{12}C^{12}C$ gives the value Psub(Λ)=-0.11+-0.28 at an error conditioned with limited statistics (approximately 90 events).

46959 **(JINR—R-1-83-96) Multiplicities of πp mesons and protons produced in inelastic interactions of deuterons and neutrons with carbon and tantalum nuclei at the (2-5) GeV/c per nucleon.** Ivanovskaya, I.A.; Prokopieva, S.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702828.

The experimental results on multiplicity distributions of secondary negative pions and protons, produced in collisions of deuterons and neutrons with carbon and tantalum nuclei at the incident momenta in the range of (2-5) GeV/c per nucleon are presented. The experimental data were analysed in the framework of the independent collision model. The pion multiplicity distributions in various interactions can be uniformly described by the modified KNO scalaing low.

46960 **(JINR—R-1-83-481) Multiplicity of the secondary charge particles in inelastic interactions of deuterons and neutrons with tantalum and carbon nuclei at 1 GeV/c per nucleon.** Bekmirzaev, R.N.; Grishin, V.G.; Muminov, M.M.; Solov'ev, M.I.; Suvanov, I.; Trka, Z.; Trkova, Ya.; Troyan, Yu.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702871.

The average multiplicities of the secondary charge particles in $d(C_2H_6)$-, dTa-, $n(C_2H_6)$-, and nTa-inelastic collisions at 1 GeV/c per nucleon are presented. It is shown that average multiplicities of π^- and π^+ mesons in dC(Ta) and nC(Ta) interactions are coincide within the error limits.

46961 **(TRI-PP—83-11) Large angle proton emission in the $^9Be(p,2p)$ reaction at 300 MeV.** Green, R.E.L.; Boal, D.H.; Helmer, R.L.; Jackson, K.P.; Korteling, R.G. (TRIUMF, Vancouver, British Columbia (Canada)). Feb 1983. 56p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84702883.

A $^9Be(p,2p)$ coincidence experiment performed to further elucidate the reaction mechanism for the production of energetic wide-angle protons in intermediate energy proton induced reactions is reported. Detectors in a coplanar geometry were used to measure coincidences between trigger protons at 90 degrees to the beam and forward angle protons on the opposite side of the beam. The incident proton energy was 300 MeV. The authors report both the inclusive spectra for the trigger protons and the differential mean multiplicities for the coincidence events.

46962 **(TRI-PP—83-14) True absorption and scattering of 50 MeV pions.** Navon, I.; Ashery, D.; Alster, J.; Azuelos, G.; Barnett, B.M.; Gyles, W.; Johnson, R.R.; Masterson, T.G.; Gill, D.R. (TRIUMF, Vancouver, British Columbia (Canada)). Mar 1983. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702881.

The inclusive pion inelastic scattering and true absorption cross sections at 50 MeV were measured for π^+ on natural Li, C, Fe, Nb, Bi and for π^- on C, Fe, Bi. The results show that π^- cross sections are much larger than π^+, the difference being significantly larger than expected from a simple Coulomb calculation. In particular, in ^{12}C the absorption of negative pions is about twice that of positive pions.

46963 **(UCRL—91217) Neutron scattering on deformed nuclei.** Hansen, L.F.; Haight, R.C.; Pohl, B.A.; Wong, C.; Lagrange, C. (Lawrence Livermore National Lab., CA (USA); CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Sep 1984. Contract W-7405-ENG-48. 5p. (CONF-840945—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE84017049.

From Topical conference on neutron-nucleus collisions--a probe of nuclear structure; Glouster, OH, USA (5 Sep 1984).

Measurements of neutron elastic and inelastic differential cross sections around 14 MeV for ^9Be, C, ^{181}Ta, ^{232}Th, ^{238}U, and ^{239}Pu have been analyzed using a coupled channel (CC) formalism for deformed nuclei and phenomenological global optical model potentials (OMP). For the actinide targets these results are compared with the predictions of a semi-microscopic calculation using Jeukenne, Lejeune, and Mahaux (JLM) microscopic OMP and a deformed ground state nuclear density. The overall agreement between calculations and the measurements is reasonable good even for the very light nuclei, where the quality of the fits is better than those obtained with spherical OMP. 8 references.

46964 **Comment on "Nuclear (π,p) reaction is consistent with a 2N absorption process".** Schiffer, J.P. (Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review Letters;* **53**: No. 7, 736-736(13 Aug 1984). Contract W-31-109-ENG-38.

Cross sections and angular distributions data are discussed for $^{12}C(\pi^+,2p)$ in order to determine the pion absorption mechanism.(AIP) ;e

46965 **(p,d) reaction at 800 MeV.** Smith, G.R.; Shepard, J.R.; Boudrie, R.L.; Peterson, R.J.; Adams, G.S.; Bauer, T.S.; Igo, G.J.; Pauletta, G.; Whitten,Jr., C.A.; Wriekat, A.; Hoistad, B.; Hoffmann, G.W. (Nuclear Physics Laboratory, University of Colorado, Boulder, Colorado 80309). *Physical Review* [*Section*] *C: Nuclear Physics;* **30**: No. 2, 593-615(Aug 1984).

The neutron pickup reaction (p,d) has been studied at a proton energy of 800 MeV on targets of ^7Li, ^{12}C, ^{13}C, ^{16}O, ^{25}Mg, ^{28}Si, and ^{40}Ca. States known to correspond to single-hole excitations are seen and in most cases the data are properly understood through distorted-wave Born approximation calculations. High-spin final states are prominent, and some are shown to be excited through multiple step processes. The strongest states seen in the data do not correspond to known levels.

46966 **Small angle pion inelastic scattering from ^{12}C at 162 MeV.** Morris, C.L.; Tanaka, N.; Boudrie, R.L.; Bland, L.C.; Fortune, H.T.; Gilman, R.; Seestrom-Morris, S.J.; Moore, C.F.; Dehnhard, D. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *C: Nuclear Physics;* **30**: No. 2, 662-665(Aug 1984).

Cross sections for elastic and inelastic pion scattering from ^{12}C at 162 MeV at angles from 8° to 32° are presented. Standard static model distorted-wave impulse approximation calculations using realistic form factors show large disagreement with the forward angle data for elastic scattering and for exciting both the 2_1^+ and 0_2^+ states.

46967 Energy dependence of angular distributions in the nonanalog pion double-charge-exchange reaction $^{16}O(\pi^+, \pi^-)^{16}Ne$(g.s.). Gilman, R.; Fortune, H.T.; Dhuga, K.S.; Kutt, P.H.; Bland, L.C.; Kiziah, R.R.; Fred Moore, C.; Seidl, P.A.; Morris, C.L.; Cottingame, W.B. (University of Pennsylvania, Philadelphia, Pennsylvania 19104). *Physical Review* [*Section*] *C: Nuclear Physics;* **29**: No. 6, 2395-2398(Jun 1984).

Previous measurements have shown that pion double-charge-exchange angular distributions between nonanalog J/sup π/ = 0^+ states at T/sub π/ = 164 MeV are consistent with simple diffractive scattering, whereas angular distributions between analog J/sup π/ = 0^+ states at T/sub π/ = 164 MeV are not. We present measurements of angular distributions for the nonanalog reaction $^{16}O(\pi^+, \pi^-)^{16}Ne$(g.s.) at two additional energies and compare the energy dependence with that expected for diffractive scattering.

6514 Nuclear Properties And Reactions, A=20-38

REFER ALSO TO CITATION(S) 65141047004

6515 Nuclear Properties And Reactions, A=39-58

46968 (FEI—1423) Strength functions of ^{57}Fe and ^{60}Ni nuclei from analysis of the (γ,n) reactions near the threshold. Kitaev, V.Ya.; Rogov, A.V.; Abramov, A.I.; Yutkin, M.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702864.

Preliminary values of resonance structure parameters of cross sections of photoneutron reactions near threshold on ^{57}Fe, ^{60}Ni isotope nuclei are obtained. Experimental spectral data are obtained using the time-of-flight method with the resolution 12 ns/m on the basis of pulse microtron. A new method of apparatus spectra processing (the method of delayed solutions), which is based on the theory of optimum statistical solutions, is tested. Evaluation of radiation Ssub(γ)=2.3 (+0.9; -0.7)x10^5 and Ssub(γ)=8 (+-2.4)x10^5 and neutron Ssub(n)=11 (+10; -3)x10^4 and Ssub(n)=13 (+5; -2)x10^4 strength functions for ^{57}Fe and ^{60}Ni isotope nuclei respectively, is made.

46969 (INDC(CCP)—208/L) Neutron spectra for (p,n) reactions involving the nuclei ^{56}Fe, ^{181}Ta and ^{197}Au at proton energies of 22.4 MeV. Svirin, M.I.; Prokhorov, S.S. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Oct 1983. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702884.

Neutron energy distributions for the reactions $^{56}Fe(p,n)$, $^{181}Ta(p,n)$, $^{197}Au(p,n)$ at proton energies of 22.4 MeV were measured in the 150-cm cyclotron of the Institute of Physics and Power Engineering, using a scintillation spectrometer with a stilbene crystal. The neutron emission spectra were analysed in terms of the cascade evaporation model. The contribution of non-statistical neutron emission is taken into account.

46970 (INDC(CCP)—209/L) Evaluation of neutron inelastic scattering cross sections for chromium. Vozyakov, V.V.; Bychkov, V.M.; Lunev, V.P.; Popov, V.I. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Oct 1983. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702885.

The nuclear level excitation functions and non-elastic (sic) and inelastic cross-sections for natural chromium were re-evaluated on the basis of recent experimental data, theoretical calculations and previously evaluated cross-sections for the (n,p), (n,pn), (n,α) and (n,2n) reactions. The evaluated cross-sections are compared with ENDF/B-V cross-sections. Data received from elsewhere have been incorporated into the Soviet library of evaluated data.

46971 Excitation of E2 transition in ^{40}Ca by 334-MeV protons. Horen, D.J.; Bertrand, F.E.; Gross, E.E.; Sjoreen, T.P.; McDaniels, D.K.; Tinsley, J.R.; Lisantti, J.; Swenson, L.W.; McClelland, J.B.; Carey, T.A.; Seestrom-Morris, S.J.; Jones, K. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review* [*Section*] *C: Nuclear Physics;* **30**: No. 2, 709-711(Aug 1984).

Measurements have been made of the inelastic cross sections and analyzing powers between 2° and 9° for nine 2^+ states in ^{40}Ca with excitation energies below 10.0 MeV excited by 334-MeV protons. The data can be well described by macroscopic distorted-wave Born-approximation calculations. In general the βR values deduced from the analysis are in agreement with those obtained by other means. We do not observe a 2^+ state at 6.422 MeV recently reported in a study of the (γ,γ') reaction. A peak at 9.868 MeV is observed which can be described by an L = (0 or 1)+2 admixture. For the L = 2 component (i.e., 2^+ state), we deduce B(E2)arrow-down = 2.0 +- 0.4 e^2fm^4.

46972 Isovector effects in nucleon inelastic scattering in a density-dependent folding model. Mellema, S.; Finlay, R.W.; Dietrich, F.S.; Petrovich, F. (Department of Physics, Ohio University, Athens, Ohio 45701). *Physical Review* [*Section*] *C: Nuclear Physics;* **29**: No. 6, 2385-2388(Jun 1984). Contract W-7405-ENG-48.

Differential cross section data for inelastic proton and neutron scattering to the first 2^+ states in ^{54}Fe and ^{56}Fe at several energies in the 11—26 MeV range have been analyzed using a microscopic distorted wave Born approximation model. The entrance- and exit-channel optical potentials and the transition form factors were calculated consistently in a folding model using a density-dependent interaction obtained from nuclear matter calculations based upon a free nucleon-nucleon interaction. These microscopic calculations yield reasonable agreement with the data. The model was used to determine the ratio of neutron and proton transition matrix elements M/sub n//M/sub p/ for these excitations.

6516 Nuclear Properties And Reactions, A=59-89

REFER ALSO TO CITATION(S) 65161047004

46973 (ECN—142) Investigation of copper nuclei - neutron capture and microscopic calculation. Delfini, M.G. (SEE CODE- 4593600 Stichting Energieonderzoek Centrum Nederland, Petten; Rijksuniversiteit Utrecht (Netherlands)). Mar 1984. 90p. NTIS (US Sales Only), PC A05/MF A01. File Number DE84702886.

The γ-radiation resulting from the capture of unpolarized and polarized thermal neutrons in copper, oriented and not oriented, has been investigated. The γ-rays observed could be placed in one of the copper level schemes. The reaction Q-value amounts to 7916.09(12) keV and 17065.91(11) keV, respectively. The chi^2 analysis of the γ-ray angular distributions obtained from capture of polarized neutrons in oriented ^{63}Cu results in three unambiguous spin assignments for levels in ^{64}Cu. The results of an investigation on ^{64}Cu by means of a spectral distribution method are reported. It is found that satisfactory agreement between theory and experiment can be obtained when single particle energies derived from a shell model fit on mass A=58, 59 are adopted. A shell model analysis of $^{60-66}Cu$ in a seniority truncated configuration space is presented. Excellent agreement between calculated and measured excitation energies is obtained for $^{63,65}Cu$, whereas for $^{64,66}Cu$ larger discrepancies occur.

46974 (JINR—R-1-83-577) Central nuclear collisions of He and C with Ag and Br at 4.5 A GeV/c momentum. Abdel'salam, A.; Vokal, S.; Tolstov, K.D. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1983. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702874.

The selection criteria of central nuclear collisions were investigated and the field of their applicability was given. The joint use of Q=0 criterium for spectator fragments of a projectile and strong destruction of a target-nucleus permits to select collisions with impact parameter less than 3 Fm. The events of central collisions are accompanied by the emission to the backward direction of at least one fast hadron. The number of relativistic particles with $\beta > 0.7$ and pions among them are proportional to the mass of a projectile nucleus. The sharp increase of these particle forward collimation is observed with increasing of projectile mass connected with the growth of the inelastically scattered protons of this nucleus. The comparison of the experimental data with the cascade evaporation model shows that this model overestimate the degree of target-nucleus disintegration.

46975 (JINR—R-3-83-634) Gamma spectra in the ^{81}Br, ^{117}Sn and ^{139}La neutron resonances non-conserving parity. Alfimenkov, V.P.; Borzakov, S.B.; Vo Van Tkhuan; Mareev, Yu.D.; Pikel'ner, L.B.; Frank, I.M.; Khrykin, A.S.; Sharapov, Eh.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1983. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702876.

Neutron capture γ-ray spectra were measured from weak p-wave resonances 0'.88 eV (^{81}Br), 1.33 eV (^{117}Sn), and 0.75 eV (^{139}La). Intensities of secondary γ-transitions, partial widths for high-energy γ-rays and thermal neutron capture cross section for ^{117}Sn (σsub(γ)-=1.32+-0.18 b) have been obtained. The isotope identification of the 0.88 eV p-resonance in bromine mentioned has been established. Results are discussed and compared with those on parity violation effects in neutron induced reactions.

46976 (JINR—R-15-83-736) Investigation of resonance structure in the interactions of protons with ^{58}Ni and ^{62}Ni nuclei reactions at low energies. Kraft, O.E.; Naumov, Yu.V.; Sigalov, V.M.; Parzhitskij, S.S.; Sizov, I.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702875.

An intermediate structure of proton resonances has been experimentally observed that manifests itself as relative signs of delta of the mixture of multipolarities of resonance γ-decay appeared to be the same. The value and the delta sign are determined on the basis of analysis of angular distributions of γ-transitions through the resonance of a compound-nucleus in the ^{58}Ni(p, γ)^{59}Cu and ^{62}Ni(p, γ)^{63}Cu reactions. For ^{58}Ni angular distributions of γ-transitions have been studied in the ^{58}Ni(p, p'γ) reaction through a resonances in ^{59}Cu, as well as multiplicity of γ-transitions in the ^{62}Ni(p, γ) reaction. These data do not contradict to the conclusion as to the intermediate structure existence. This structure is interpreted as a distribution of the strength of the Gamov-Teller resonance over the resonance states of a more complicated structure.

46977 (ORNL/TM—9083) Calculated neutron-induced cross sections for $^{63, 65}$Cu from 1 to 20 MeV and comparisons with experiments. Hetrick, D.M.; Fu, C.Y.; Larson, D.C. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 136p. (ENDF—337). NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84016578.

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Nuclear model codes were used to compute cross sections for neutron-induced reactions on both ^{63}Cu and ^{65}Cu for incident energies from 1 to 20 MeV. The input parameters for the model codes were determined through analysis of experimental data in this energy region. Discussion of the models used, the input data, the resulting calculations, extensive comparisons to measured data, and comparisons to the Evaluated Nuclear Data File (ENDF/B-V) for Cu (MAT 1329) are included in this report.

6517 Nuclear Properties And Reactions, A=90-149

46978 (AECL—7980) Bound coherent and incoherent thermal neutron scattering cross sections of the elements. Sears, V.F. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Dec 1982. 29p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702856.

An up-to-date table of bound coherent and incoherent thermal neutron scattering cross sections of the elements is presented. Values from two different data sources are calculated and compared. These sources are: (1) the free-atom cross sections listed in the Σbarn bookΣ and (2) the Julich scattering length tables. We also call attention to, and clarify, the confusion that exists in the literature concerning the sign of the imaginary part of the complex scattering length.

46979 (DOE/ER/04831—7) Neutrinoless double beta decay. Annual progress report, January 1, 1984-December 31, 1984. Nicholson, H.W. (Mount Holyoke Coll., South Hadley, MA (USA)). Aug 1984. Contract AC02-78ER04831. 13p. (COO—4831-7). NTIS, PC A02/MF A01; GPO Dep. File Number DE84017424.

Work is continuing on a collaborative experiment with experimenters from the Lawrence Berkeley Laboratory to search for neutrinoless double beta decay in Mo^{100}. We have developed a hybrid, lithium drifted, silicon surface barrier detector 1.5 mm thick and 7.1 cm in diameter which, operating at LN_2 temperature and in conjunction with an Amptek A225 low noise preamplifier and amplifier chip, gives an electronic resolution of 18 keV FWHM. At present, we have 8 working detectors of this type and another 8 currently being fabricated, and we expect to have between 50 and 70 of these detectors working by January 1985. We have also fabricated 5 grams of isotopically pure Mo^{100} into 7 micron thick circular foils 7.1 cm in diameter and have constructed a titanium cryostat with an oxygen-free, high conductivity electrolytic (OFHC) copper dipstick which currently contains a stack of 6 detectors and is being used to evaluate backgrounds from the residual natural radioactivity remaining in the detector system. We hope to begin taking data with 5 to 10% of the full array by early 1985.

46980 (ITEF—181(1983)) Study on the P-odd asymmetry of longitudinally polarized neutron transmission in ^{117}Sn, ^{233}Th, ^{239}Pu isotopes and natural mixture of Cl and Pb isotopes. Abov, Yu.G.; Ermakov, O.N.; Karpikhin, I.L.; Krupchitskij, P.A.; Kuznetsov, Yu.Eh.; Perepelitsa, V.F.; Petrushin, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702867.

The results of measurements of P-odd helicity dependence of the total cross-section a=(σsub(tot)sup(+)-σsub(tot)sup(-))/(σsub(tot)sup(+)+σsub(tot)sup(-)) for thermal neutrons on several targets are presented. The result for ^{117}Sn is a=(11.2+-2.6)x10^{-6}. The upper limits for a in the region of several units of 10^{-6} are obtained for ^{232}Th, ^{239}Pu, Cl (natural) and Pb (natural).

46981 (JINR—E-1-83-234) Experimental study of the pion-xenon nucleus collisions without particle production at 3.5 GeV/c momentum: angular distributions of emitted protons. Strugalski, Z.; Pawlak, T.; Pluta, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702869.

Angular distributions of fast protons, with kinetic energy from about 20 to about 400 MeV, emitted in pion-xenon with collisions without particle production at 3.5 GeV/c momentum are studied. It can be concluded that: 1/ Proton emission angles occur from 0 up to 180 degrees; 2/ There are not evident irregularities in angular distributions; 3/ The av range proton mission angle does not depend on the multiplicity of emitted protons, when its multiplicity is larger than 1; 4/ The shapes of the proton angular distribuitons do not depend on the multiplicity of emitted protons.

46982 (JINR—E-1-83-277) Particle multiplication in hadron-nucleus collisions. Sredniawa, B.; Strugalska-Gola, E. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702844.

Multiplication of particles in hadron-nucleus collisions, expressed by the ratio Rsub(A) between the multiplicity of particles in hadron-nucleus collisions and the multiplicity of particles in hadron-nucleon collisions, is analysed. Energy- and A-dependence of Rsub(A) for 24 target nuclei from $_{6}{}^{12}$C to $_{92}{}^{238}$U are calculated using formulae derived from the Strugalski free-parameterless model: for pion-nucleus collisions in the range 8.1-147 GeV/c and for proton-nucleus collisions between 12 and 1480 GeV/c. The Rsub(A)-values for pion-nucleus collisons are variable between 1.1 and 1.9, those for proton nucleus collisions vary between 1.8 and 2.8. In all cases Rsub(A)-dependence at constant momentum of incident particle and momentum dependences at constant A increase regularly and slowly. The agreement of calculation results with available experimental data is very good in the whole A- and energy range.

46983 (JINR—E-4-83-401) Shape of fast-rotating nuclei in the region of subshell N--82. Cwiok, S.; Mikhajlov, I.N.; Briancon, Ch. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702854.

The fast rotating even isotopes of erbium (^{146}Er, sup(148-154)Er and ^{158}Er) in the vicinity of N=82 are investigated in the framework of the Strutinsky smell-correction method. The Woods-Saxon potential including non-axial hexadecapole deformations is used. The equilibrium deformation and moment of inertia are calculated for different spin values. The influence of nuclear temperature on the shell-effects is also discussed.

46984 (JINR—R-1-83-237) Experimental study of the pion-xenon nucleus collisions at 3.5 GeV/c momentum; angular distributions of emitted protons. Strugal'skij, Z.; Abrosimov, A.T.; Vosinskaya, K.; Il'ina, A.N.; Miller, K.; Okhrimenko, L.S.; Pavlyak, T.; Plyuta, Ya.; Pehryt, V.; Srednyava, B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702870.

Results of experimental investigation of the angular distributions of fast protons, of kinetic energy from about 20 to about 400 MeV, emitted in pion-xenon nucleus collisions at 3.5 GeV/c momentum are presented. It can be concluded that: 1) the emission of fast protons cannot be regarded as a simple knocking-out process; 2) angular characteristics of the protons indicate that these protons have not interacted inside the target nucleus.

46985 (JINR—R-1-83-564) Experimental study of the pion-xenon nucleus collisions at 3.5 GeV/c. Relative intensities of particle emission. Strugalski, Z.; Abrosimov, A.T.; Wosinska, K.; Il'ina, A.N.; Miller, K.; Okhrimenko, L.S.; Pavlak, T.; Pluta, Ya.; Peryt, W.; Sredniawa, B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702872.

Experimental investigations of the relative intensities of the particle emission in pion-xenon nucleus collisions at 3.5 GeV/c are performed. It is obtained that: 1) the charged multiplicity changes from 0 to 17; 2) the multiplicity of pion production of any electric charge changes from 0 to 8, the maximum of the multiplicity is 3; 3) the pion multiplicity value 0 is distinguished in the multiplicity distribution; the intensity of the proton emission coresponding to this value is more than two times larger than the intensity at other values.

46986 (JINR—R-1-83-568) Experimental study of the pion-xenon nucleus collisions at 3.5 GeV/c. Neutral pion production. Strugalski, Z.; Abrosimov, A.T.; Wosinska, K.; Pawlak, T.; Pluta, J.; Sredniawa, B.; Il'ina, A.N.; Okhrimenko, L.S.; Peryt, W.; Miller, K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702873.

Experimental investigations of the neutral pion production are performed in pion-xenon collisions at 3.5 GeV/c. It is obtained that: 1) the average neutral pion multiplicity changes with the multiplicity of the protons emitted; 2) nearly 20% of the pions produced are emitted into the backward hemisphere; 3) the energy spectrum of the neutral pions is smooth; 4) the longitudinal component of the neutral pion momentum changes within the limits from -600 MeV/c to +1800 MeV/c; 5) the average value of the transversal component of the neutral pion momentum changes with the multiplicity of the protons emitted from approximately 270 to approximately 170 MeV/c; 6) the average value of the cosine of the neutral pion emission angle decreases with the multiplicity of the protons emitted.

46987 (JINR—R-4-83-600) Total radiative widths of neutron resonances and photon dipole strength function of compound-compound gamma transitions. Kadmenskij, S.G.; Lomachenkov, I.A.; Popov, A.B.; Furman, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1983. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702849.

Total radiation widths of s-neutron resonances for intermediate and heavy spherical nuclei in the range 78<=A<=200 are calculated in the framework of statistical approach without using free parameters. The effect of the choice of density of low-lying excited states on values of the total radiation widths is analyzed. On the basis of obtained satisfactory agreement between the calculation results and experimental data the conclusion is drawn about approximate equality and constancy of E1- and M1-strength functions of the low energy compound-compound γ-transitions.

46988 (TRI-PP—83-10) Information on pion-nucleus optical potentials from elastic scattering. Friedman, E. (TRIUMF, Vancouver, British Columbia (Canada)). Feb 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702861.

Data on the elastic scattering of pions by nuclei between 20 and 230 MeV is analyzed in an almost model-independent fashion. The real part of the potential, which is described by a bias-free Fourier-Bessel series, is found to have the typical Kisslinger or Laplacian-like shape between 30 and 80 MeV.

46989 Beta-delayed proton activities: ^{147}Dy and ^{149}Er. Toth, K.S.; Moltz, D.M.; Schloemer, E.C.; Cable, M.D.; Avignone,III, F.T.; Ellis-Akovali, Y.A. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review [Section] C: Nuclear Physics;* **30**: No. 2, 712-714(Aug 1984).

The β-delayed proton spectra of ^{147}Dy and the hitherto unknown isotope ^{149}Er were investigated in ^{12}C bombardments of ^{142}Nd and ^{144}Sm, respectively. The ^{12}C+ ^{142}Nd data confirm preliminary results of Klepper et al that the ^{147}Dy delayed-proton spectrum has a high-energy cutoff at ~5 MeV and is dominated by distinct peaks below 4 MeV in excitation. The proton spectrum following ^{149}Er decay has a half-life of 9 +- 1 sec and extends from about 2.0 to 6.5 MeV; it has less of the sharp structure observed for ^{147}Dy. The difference probably arises from the expected lower level density in ^{147}Tb, a nucleus with one proton outside the ^{146}Gd core.

46990 Nuclear shape at high spin and excitation energy. Gaarhoje, J.J.; Ellegaard, C.; Herskind, B.; Steadman, S.G. (The Niels Bohr Institute, University of Copenhagen, DK-2100 Copenhagen, Denmark). *Physical Review Letters;* **53**: No. 2, 148-151(9 Jul 1984). Contract AC02-76ER03069.

High-energy gamma rays from the deexcitation of giant dipole resonance modes have been measured for the decay of ^{108}Sn and ^{160}Er. The structure of the observed resonances can be correlated with the shapes of these nuclei at high excitation energy (E(≃60 MeV). For the deformed system ^{160}Er a shape change with increasing temperature is suggested.

46991 Mass and low-lying levels of /sup 106,108/In from the /sup 106,108/Cd(p,nγ) reactions. Filippone, B.W.; Davids, C.N.; Pardo, R.C.; Aystoe, J. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] C: Nuclear Physics;* 29: No. 6, 2118-2125(Jun 1984). Contract W-31-109-ENG-38.

^{106}In has been studied via the reaction ^{106}Cd(p,nγ)^{106}In in the energy range E/sub p/ = 7—9 MeV. In-beam γ-ray excitation functions, γ-γ coincidence measurements, and β^+-delayed γ-ray excitation functions have been used to identify thirteen levels in ^{106}In. From this new level scheme the energy separation of the high-spin ground state and the low-spin isomer has been determined to be 28.6 +- 0.5 keV. The threshold energy of the strongest low-lying γ-ray transition yields a mass excess for ^{106}In of -80601 +- 15 keV. Spins for some states are suggested by comparing the excitation functions to Hauser-Feshbach calculations. In-beam γ-ray excitation functions for the ^{106}Cd(p,nγ)^{103}In reaction give a mass excess for the 3^+ β^+-decaying state in ^{103}In of -84018 +- 12 keV. The systematics of odd-odd In nuclei are discussed in a j-j coupling model.

6518 Nuclear Properties And Reactions, A=150-189

REFER ALSO TO CITATION(S) 65181046983, 47028

46992 (JINR—6-83-617) Properties of the ^{165}Er low excited states. Budzynski, M.; Kochetov, O.I.; Lizurej, G.I.; Morozov, V.A.; Muminov, A.I.; Sarzhinski, Ya. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702878.

As a result of the investigation of angular correlation of the γ radiation in ^{165}Tm→^{165}Er decay the multipole composition of a number of the γ-transition is made more precise. The lifetime of the 589.8 keV ($1/2^-$) level is determined Tsub(1/2 .... .. the magnetic moment of the 242.9 keV level in ^{165}Er is measured by the IPAC method of γγ-correlation: μ=-0.51(14) n..m. The analysis available of the experimental data in the framework of modern nuclear semimicroscopic models of nucleus shows necessity to take into account the influence of the Coriolis interaction at the description of the magnetic moments of the rotational bands of negative parity in sup(161, 163, 165)Er isotopes.

46993 (JINR—E-4-83-754) Charge-exchange dipole and spin-dipole resonances in deformed nuclei. Solov'ev, V.G.; Sushkov, A.V.; Shirikova, N.Yu. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702846.

The (p, n) and (n, p) transition strength functions with excitation spin-dipole (with lambdasup(π)=0sup(-), 1^-, 2^-) and E1 charge-exchange resonances in deformed nuclei in the regions 156 <= A <= 168 and 236 <= A <= 240 are calculated in the RPA. It is shown that the spin-dipole resonance with lambdasup(π) = 0^-, 1^-, and 2^- strength is distributed within 14-33 MeV. The maximum region of this resonance contains (87-89)% of the (p, n) strength. The low-energy part 2-14 MeV has only the states with lambda=2. The E1 charge-exchange resonance is distributed within 25-29 MeV. It is splitted with ΔE equal to 0.6-2 MeV into two peaks with Isup(π)K=1^-O and 1^-1. This resonance strength is concentrated in a narrower energy region in comparison with the ordinary E1 giant resonance. In the region of 4-7 MeV around maximum (73-77)% of E1 strength is concentrated. The total (n, p) transition strength is 10-200 times as small as the total (p, n) transition strength.

46994 (JINR—R-4-82-934) K nonconservation in neutron resonances and spin dependence of neutron strength functions of deformed nuclei. Kadmenskij, S.G.; Markushev, V.P.; Popov, Yu.P.; Furman, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1982. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702847.

Theoretical treatment of level spacing of the compound-nucleus states with fixed Jsup(π) for some deformed nuclei from ^{154}Gd-^{236}U range is given. It is obtained that the projection of the neutron resonance spin on the nuclear axis K is not good quantum number. The new formulae for spin dependent s-wave neutron strength functions of the deformed nuclei are obtained. A comparison of experimental neutron strength functions and theoretical ones leads to the conclusion that all projections K enter the wave function of a neutron resonance with the equal weights.

46995 (JINR—R-4-83-723) Description of charge-exchange resonances in deformed nuclei. Solov'ev, V.G.; Sushkov, A.V.; Shirikova, N.Yu. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702850.

The (p, n) and (n, p) transition strength functions with excitation of charge-exchange resonances in deformed nuclei are calculated in RPA. The (p, n) and (n, p) transition with excitation of the Gamon-Teller (GT) resonances and other 1^+ states are calculated in nuclei in the 156 <= A <= 168 and 236 <= A <= 240 regions. It is shown that the GT resonance should be observed in all the deformed nuclei at 18-20 MeV for about (60-70)% concentration of strength in the energy range from 5 upto 6 MeV. The splitting of the GT resonances with the components K=0 and K=1 should not exist. The GT resonance characteristics weakly depend on A. There is a low-energy part of the GT resonance containing (20-25)% of the total strength. The centroid energy of this part is 10-12 MeV. The total (n, p) transition strength is 35-170 times as small as the total (p, n) transition strength.

46996 (JINR—R-4-83-814) Making allowance of Pauli principle at investigation of vibrational state anharmonicity in deformed nuclei. Meliev, F.M.; Shirikova, N.Yu. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702851.

Using new phonon operators which depend on a sign of angular momentum projection onto the symmetry axis of a deformed nucleus, excited states of even even deformed nuclei are described. The influence of the quasiparticle-phonon interaction taking into account the residual multipole-multipole interaction and Pauli's principle in the two-phonon components of the wave functions on the structure and energy of vibrational states of even-even deformed nuclei is studied. The conclusion is confirmed that the collective two-phonon states should not exist in even-even deformed nuclei.

46997 (LUNFD6/NFFK—7028/1-21(1983)) Experimental results on the study of high-spin states in ^{165}LU. Jonsson, S.; Lyttkens, J.; Carlen, L. and others. (Lund Univ. (Sweden)). Mar 1983. 27p. (LUIP—8305). NTIS (US Sales Only), PC A03/MF A01. File Number DE84702888.

High-spin states ^{165}Lu have been populated in the ^{153}Eu(^{16}O,4n) reaction. An excitation function measurement was made to assign correct γ-rays to ^{165}Lu. A level scheme was constructed from the studies of γ-γ coincidences, and the measurement of γ-ray angular distributions. Five rotational bands have been assigend to ^{165}Lu, and identified as the ones built on the 5/2(sup)+(402), 1/2(sup)+(411), 1/2(sup)-(541), 7/2(sup)+(404) and 9/2(sup)-(514) Nilsson states. Both signatures are seen for all of them except the one built on the 1/2(sup)-(541) Nilsson orbital. The crossing frequencies, for the bands observed above backbending, are determined and the variation in the crossing frequency is discussed.

6519 Nuclear Properties And Reactions, A=190-219

46998 (ARL/TR—060, pp 122-127) Use of solid state detectors for spectrometry of conversion electrons emitted in the decay of lead-210. Leith, I.S. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

The use of silicon surface barrier detectors of high resolution for the measurement in vacuum of conversion electrons emitted in the decay of ^{210}Pb has been investigated. The project is also concerned with the development of L X-ray spectrometry using a thin window NaI(Tl) scintillation detector and its incorporation into a

method of measuring CE sub(L)/L sub(X) coincidence electron spectra in air for ^{210}Pb decay.

46999 **(CONF-840882—1) Energy dissipation in heavy systems: the transition from quasi-elastic to deep-inelastic scattering.** Rehm, K.E.; van den Berg, A.; Kolata, J.J.; Kovar, D.G.; Kutschera, W.; Rosner, G.; Stephans, G.S.F.; Yntema, J.L.; Lee, L.L. (Argonne National Lab., IL (USA); State Univ. of New York, Stony Brook (USA)). 1984. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016231.

From International symposium on heavy ion physics; Mt. Fuji, Japan (27 Aug 1984).

The interaction of medium mass projectiles (A = 28 - 64) with ^{208}Pb has been studied using a split-pole spectrograph which allows single mass and charge identification. The reaction process in all systems studied so far is dominated by quasi-elastic neutron transfer reactions, especially at incident energies in the vicinity of the Coulomb barrier. In addition to the quasi-elastic component deep inelastic contributions are present in all reaction channels. The good mass and charge separation allows to generate Wilczynski plots for individual channels; for the system ^{48}Ti + ^{208}Pb we observe that the transition between the quasi-elastic and deep-inelastic reactions occurs around Q = -(30 to 35) MeV.

47000 **Stopping power and collective flow of nuclear matter in the reaction Ar+Pb at 0.8 GeV/u.** Renfordt, R.E.; Schall, D.; Bock, R.; Brockmann, R.; Harris, J.W.; Sandoval, A.; Stock, R.; Stroebele, H.; Bangert, D.; Rauch, W.; Odyniec, G.; Pugh, H.G.; Schroeder, L.S. (Institut fuer Hochenergiephysik der Universitat, D-6900 Heidelberg, Federal Republic of Germany). *Physical Review Letters;* **53**: No. 8, 763-766(20 Aug 1984). Contract AC03-76SF00098.

Charged-particle exclusive data for Ar+Pb collisions at 0.772 GeV/u are analyzed in terms of collective variables for the event shapes in momentum space. Semicentral collisions lead to sidewards flow whereas nearly head-on collisions have spherical shapes in the c.m. frame, resulting from complete stopping of projectile motion. The hydrodynamical model predictions agree qualitatively with the data whereas the standard cascade model disagrees, lacking in stopping power and collective flow.

47001 **Simultaneous description of quasielastic and fusion reactions in low-energy heavy-ion collisions.** Rhoades-Brown, M.J.; Prakash, M. (Physics Department, State University of New York at Stony Brook, Stony Brook, New York 11794). *Physical Review Letters;* **53**: No. 4, 333-336(23 Jul 1984). Contract AC02-76ER13001.

A unified approach is used to describe quasielastic and fusion processes in heavy-ion reactions at near barrier energies. The spin distributions for fusion are used in conjunction with transition-state theory to calculate fission fragment angular distributions. Results for the reaction ^{16}O+^{208}Pb show that when transfer contributions are small, satisfactory agreement with data is obtained. The role of fragment anisotropy as a useful probe of entrance channel effects at energies close to the barrier is pointed out.

47002 **Angular distributions and mechanisms of fragmentation by relativistic heavy ions.** Stoenner, R.W.; Haustein, P.E.; Cumming, J.B. (Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **53**: No. 4, 341-343(23 Jul 1984). Contract AC02-76CH00016.

Angular distributions of massive fragments from relativistic heavy-ion interactions are reported. Sideward peaking is observed for the light fragment ^{37}Ar, from 25-GeV ^{12}C+Au, while the distribution for ^{127}Xe is strongly forward peaked. Conflicts of these observations and other existing data with predictions of models for the fragmentation process are discussed.

47003 **Nuclear data sheets for A = 192.** Shirley, V.S.; Dairiki, J.M. (Lawrence Livermore Laboratory, Berkeley, California 94720, USA). *Nuclear Data Sheets;* **40**: No. 4, 425-522(Dec 1983). Contract AC03-76SF00098.

Experimental data pertaining to all nuclei with mass number A = 192 have been evaluated. Level schemes from both radioactive decay and studies are presented, along with associated tables of experimental data and adoped properties for levels and transitions. Substantial evaluation effort went into the construction of a comprehensive decay scheme for the ϵ/β^+ decay of ^{192}Au. For the first time, level intensity balances and decay feedings were determined from published positron, conversion electron, and photon data.

6520 Nuclear Properties And Reactions, A=220 And Above

47004 **(AECL—8060) Neutronic evaluations of activations in graphite-thorium assemblies, 14 MeV neutron sources. Comparisons with measurements.** Kushneriuk, S.A.; Wong, P.Y. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Apr 1983. 57p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84702857.

Results are presented of neutronic evaluations of activations induced in foils irradiated at various positions within the INRS irradiation facility; comparisons with the results of measurements are made. In the measurements, DT-generated neutrons resulting from accelerated deuterium (60 keV) striking a tritiated target located at the centre of the facility were used. The activities considered were those induced via the ^{27}Al(n,p)^{27}Mg, ^{27}Al(n,a)^{24}Na, ^{63}Cu(n,2n)^{62}Cu, ^{127}I(n,2n)^{126}I, ^{90}Zr(n,2n)^{89}Zr, sup(115)In(n,γ)sup(116m)In, ^{197}Au(n,γ')^{198}Au, ^{232}Th(n,γ)^{233}Th and ^{232}Th(n,f)^{99}Rb (F.P.) reactions. The calculations were made using the MORSE Monte Carlo neutronics code in the 25-neutron-group approximation for determining the fluxes, and a specially prepared 25-neutron-group Σactivities Σ library of reaction cross sections for determining the resultant reaction rates.

47005 **(EGG-M—12384) Current status of nuclear decay data and report on the IAEA Coordinated Research Programme on the measurement and evaluation of transactinium isotope nuclear decay data.** Reich, C.W.; Vaninbroukx, R. (EG and G Idaho, Inc., Idaho Falls (USA); Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). 1984. Contract AC07-76ID01570. 27p. (CONF-8405229—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84014636.

From 3. IAEA advisory group meeting on transactinium isotope nuclear data; Uppsala, Sweden (21 May 1984).

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In 1977, the IAEA organized a Coordinated Research Programme to address the needs for highly accurate actinide-nuclide decay data identified at the first Advisory Group Meeting on Transactinium Isotope Nuclear Data, held in Karlsruhe in 1975. During the years of its existence, this CRP has made significant strides towards achieving the goals outlined at Karlsruhe and subsequently refined at a second Advisory Group Meeting, held in Cadarache in 1979. In this paper, the make-up of the CRP and its work in the areas of decay-data measurement and evaluation are presented and its significant accomplishments summarized. We also discuss the contents and philosophy of the final report, containing the results of the measurements and evaluations carried out by the CRP participants, to be published following the planned termination of this Programme in November, 1984. 82 references.

47006 **(IAE—3646/2) Measurement of space-odd asymmetry coefficient of fragment divergence in the uranium 233 fission by thermal neutrons.** Bondarenko, L.N.; Erozolimskij, B.G.; Korobkina, E.I.; Pevchev, Yu.F.; Sadchikov, A.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702865.

Asymmetry coefficient of fragment divergence relatively to the spin of absorbed neutron in the uranium-233 fission has been measured with an ionization chamber on a beam of thermal polarized neutrons. The obtained value a=(4.9+-0.8)x10^{-4} agrees well with data available.

47007 **(INDC(BZL)—9/GIJV) Updating of the LEOPARD data library.** Henrique Claro, L.; Cunha Menezes Filho, A. da. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jan 1984. 19p. (INT—(84)-1). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702889.

The LEOPARD library is being updated and tested for typical PWR unit cells with enrichments ranging from 1.0 to 4.1%(W/o) and H_2O:U ratios varying from 1.0 to 10.0. A reasonably good agreement with experimental values for some spectral indices is obtained if the fission cross-section of ^{235}U is reduced by 0.6% in the thermal range and by 20% in the epithermal range, the epithermal capture cross-section for ^{235}U is increased by about 20% and the number of neutrons per fission in the thermal range of ^{235}U is increased by 0.8%.

47008 **(INDC(CCP)—211/L) Simultaneous multi-level analysis of the total and fission cross-sections of ^{239}Pu up to 160 eV.** Kolesov, V.V.; Luk'yanov, A.A. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Oct 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702890.

In order to describe cross-sections a multi-level scheme based on S-matrix theory was used taking the Doppler effect and the resolution into account. A multi-level analysis of the total cross-section and fission cross-section of ^{239}Pu was made by the least-squares method in the energy region up to 160 eV. The experimental cross-section data used have a good resolution. The multi-level parameters can be used to represent all the features of the detailed energy structure of experimental cross-sections where the regions of interference minima are of the greatest interest.

47009 **(INDC(NDS)—147/GE) Sixth research coordination meeting on the measurement and evaluation of transactinium isotope nuclear data. Summary report.** Lorenz, A. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Nov 1983. 46p. (CONF-8306213—Summ.). NTIS (US Sales Only), PC A03/MF A01. File Number DE84702891.

From 6. research coordination meeting on the measurement and evaluation of transactinium isotope nuclear data; Idaho Falls, ID, USA (21 Jun 1983).

Proceedings of the sixth meeting of the participants in the IAEA Coordinated Research Programme to measure and evaluate the required nuclear decay data of heavy element radionuclides, convened by the IAEA Nuclear Data Section on 21-24 June 1983 at Idaho Falls, USA. The meeting participants reviewed the data requirements, updated and extended the recommended list of half-lives, and continued to review the status of alpha and gamma radiation spectra emitted in the decay of transactinium isotopes.

47010 **(INDC(NDS)—149/NE) Proposed recommended list of heavy element radionuclide decay data. Pt. 1. Half-lives. Pt. 2. Alpha spectra. Pt. 3. Gamma-ray spectra. December 1983 ed.** Lorenz, A. (ed.). (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Dec 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702892.

The objective of the IAEA Coordinated Research Programme (CRP) on the Measurement and Evaluation of Transactinium Isotope Nuclear Decay Data, is to arrive at a consistent set of transactinium isotope decay data and their uncertainties (including half-lives, branching fractions and gamma-ray and alpha emission spectra) which would satisfy the requirements identified by the community of data users. Since the beginning of this activity in 1978, the scope radionuclides covered has widened to include most radionuclides which occur in or result from the nuclear fuel cycle. The sets of heavy radionuclide decay data, compiled and reviewed by members of the CRP, constitutes the "Proposed Recommended List" presented in this report.

47011 **Nuclear data sheets for A = 234.** Ellis-Akovali, Y.A. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830, USA). *Nuclear Data Sheets;* **40**: No. 4, 523-595(Dec 1983). Contract AC05-84OR21400.

The available nuclear structure information for all nuclear with mass number A = 234 is presented. Various decay and reaction data are evaluated and compared. Adopted data, levels, spin, parity, and configuration assignments are given.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 65300046898, 46926, 46937, 46947, 46982, 46988

47012 **(BNL—35105) Heavy ions at steamboat: summary of parallel sessions.** Ludlam, T.W. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 12p. (CONF-8405193—40). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016994.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

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The interest in heavy ions at the intersection between particle and nuclear physics is motivated by the opportunity for an entirely new approach to the understanding of fundamental interactions by studying extreme states of nuclear matter. At this conference we have seen important new results on some of the central issues including: (1) how well can we predict the landscape of the extremes - that is, the phase structure of QCD and nuclear matter; (2) can we explore it with heavy ion collisions; and (3) can we recognize the appearance of new terrain. Our present understanding of the behavior of nuclear matter under extreme conditions is briefly discussed. 16 references. (WHK)

47013 **(BNL—35168) Axial asymmetry, finite particle number and the IBA.** Casten, R.F. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 16p. (CONF-8405231—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016997.

From International workshop on interacting boson-boson and boson-fermion systems; Gull Lake, MI, USA (28 May 1984).

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Although the IBA-1 contains no solutions corresponding to a rigid triaxial shape, it does contain an effective asymmetry. This arises from zero point motion in a γ-soft potential leading to a non-zero mean or rms γ. Three aspects of this feature will be discussed: (1) The relation between IBA-1 calculations and the corresponding γ. This point is developed in the context of the Consistent Q Formalism (CQF) of the IBA. (2) The dependence of this asymmetry on boson number, N, and the exploitation of this dependence to set limits on both the relative and absolute values of N for deformed nuclei. (3) The relation between this asymmetry and the triaxiality arising from the introduction of cubic terms into the IBA Hamiltonian. Various observables will be inspected in order both to determine their sensitivity to these two structural features and to explore empirical ways of distinguishing which origin of asymmetry applies in any given nucleus. 16 references.

47014 **(CONF-840784—2) Mesonic and dibaryonic excitations in the πNN system.** Lee, T.S.H. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016318.

From Nucleon and nuclear structure and exclusive electromagnetic reaction studies workshop; Cambridge, MA, USA (23 Jul 1984).

A πNN theory, incorporating mesonic and dibaryonic excitation mechanisms, is introduced to give a unified description of NN and πd reactions. The mesonic mechanism is built into the theory along the line of the Paris potential. The dibaryonic excitation at short distance is introduced according to current understanding of six quark dynamics. The effect of the 2^+, T = 1 six-quark state on NN and πd scattering is presented. The implication of the theory in the study of electromagnetic interaction with deuteron is discussed. 11 references.

47015 **(DOE/ER/03235—91) Nuclear excitations and reaction mechanisms. Progress report, 1 August-31 July 1984.** Fallieros, S.; Levin, F.S. (Brown Univ., Providence, RI (USA). Dept. of Physics). 1 Aug 1984. Contract AC02-76ER03235. 19p. (COO—3235-91). NTIS, PC A02/MF A01; GPO Dep. File Number DE84017343.

This progress report describes activities of the Nuclear Theory group at Brown University during the period 1 August 1983 to 31 July 1984. Completed and ongoing research include various theoretical and numerical studies of few-particle systems, nuclear reaction models, nuclear electroexcitation and photon scattering from nuclei. In addition, research on atomic and molecular structure has essentially been concluded and no further DOE-supported research in this area is anticipated.

47016 **(DOE/ER/13001—40) Research in theoretical nuclear physics, Nuclear Theory Group. Progress report.** Brown, G.E.; Jackson, A.D.; Kuo, T.T.S. (State Univ. of New York, Stony Brook (USA). Dept. of Physics). 1984. Contract AC02-76ER13001. 193p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE84016613.

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Primary emphasis is placed on understanding the nature of nucleon-nucleon and meson-nucleon interactions and on determining the consequences of such microscopic interactions in nuclear systems. We have constructed models of baryons which smoothly interpolate between currently popular bag and Skyrme models of hadrons and provide a vehicle for introducing the notions of quantum chromodynamics to low energy nuclear physics without violating the constraints of chiral invariance. Such models have been used to study the nucleon-nucleon interaction, the spectrum of baryons, and the important question of the radius of the quark bag. We have used many-body techniques to consider a variety of problems in finite nuclei and infinite many-body systems. New light has been shed on the nuclear coexistence of spherical and deformed states in the A = 18 region as well as the role of genuine three-body forces in this region. Phenomenological studies of infinite systems have led to a number of predictions particularly regarding the spin-polarized quantum liquids of current experimental interest. Microscopic many-body theories, based on the parquet diagrams, have been improved to a fully quantitative level for the ground state properties of infinite many-body systems. Finite temperature theories of nuclear matter, important in the study of heavy ion reactions, have been constructed. An expanded program in heavy ion theory has led to major advances in the multi-dimensional barrier penetration problem. Activities in nuclear astrophysics have provided a far more reliable description of the role of electron capture processes in stellar collapse. As a consequence, we have been able to perform legitimate calculations of the unshocked mass in Type II supernovae.

47017 **(DOE/ER/40132—T1) Theoretical research in nuclear collective motion. Progress report.** (Pennsylvania Univ., Philadelphia (USA)). 11 Sep 1984. Contract AC02-84ER40132. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017467.

Progress is summarized on the following research projects: generalized density matrix method, large amplitude collective motion, boson mappings for the Interacting Boson Model, and semi-classical method for testing IBM hypothesis. (WHK)

47018 **(INDC(CCP)—217/LI) Contribution of direct and statistical reaction mechanisms during fast neutron scattering at low-lying levels of light and medium nuclei.** Bychkov, V.M.; Ignatyuk, A.V.; Lunev, V.P.; Seeliger, D.; Unholzer, S.; Schmidt, D.; Streil, T.; Hermsdorf, D. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Dec 1983. 59p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84702858.

The authors analyse the basic characteristics of the behaviour of the neutron excitation functions for low-lying levels of nuclei and discuss the interrelationship between these characteristics and the parameters of the optical and statistical models used for their description. They consider the differences in the parameters of the dynamic deformation of nuclei which occur in the direct inelastic nucleon scattering reactions and during Coulomb excitation of low-lying collective levels. It is shown that direct transitions make a substantial contribution to the excitation functions for discrete levels even at comparatively low neutron energies. The authors have investigated the role played by the structural changes of the neutron strength functions in the interpretation of the observed energy dependence of the inelastic scattering cross-sections in the near-threshold region.

47019 **(ITEF—91(1983)) Statistical simulation of hadron-nucleus and light nucleus-nucleus interaction. Intranuclear cascade model.** Lobov, G.A.; Stepanov, N.V.; Sibirtsev, A.A.; Trebukhovskij, Yu.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. 26p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE84702835.

A new version of the program of statistical simulation of hadron-nucleus and light nucleus-nucleus interaction is elaborated. The cascade part of the program is described. The comparison of model predictions with the proton-nucleus interaction experiments is performed. A satisfactory calculations-experiment agreement is obtained.

47020 **(ITF—82-141-R) Correlation dependences between the low-energy parameters in few-nucleon systems. The quartet state of three nucleons.** Grinyuk, B.E.; Simenog, I.V.; Sitnichenko, A.I. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1982. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702837.

The scattering length asub(3/2) and the effective radius rsub(3/2) (in the S=3/2 state of three nucleons) are expanded in powers of the two-particle effective radius rsub(t deg). Correlations between the three- and two-particle scattering parameters are explained, and numerical calculations of asub(3/2) and rsub(3/2) for a number of different forms of interaction potential are systemized. An influence of the energy dependence of interaction on the value of asub(3/2) is also considered.

47021 **(ITF—82-165-R) Triton binding energy and the nd-scattering lengths with account of a quark nucleon structure.** Petrov, N.M.; Pushkash, A.M. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1983. 13p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702838.

A simple model for the nucleon-nucleon interaction is suggested which takes into account the quark nucleon structure. Using this model the triton binding energy and the nd-scattering lengths are calculated.

47022 **(ITF—83-50-R) Elastic and transition form factors for the collective states of magic and near magic nuclei in the GHF method.** Steshenko, A.I.; Maksimenko, V.N. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1983. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702840.

A method for calculating the matrix elements of a nuclear form factor operator in the basis of collective functions Sp(2,R) is proposed. The formulas obtained can be used in the calculatings of the charged elastic and transition form factors for the collective states of magic and near magic nuclei by means of the generalized hycerspherical function method.

47023 **(ITF—83-91-R) Towards the dependence of integral cross sections on the form of n-p potential at diffraction deuteron-nucleus interaction.** Evlanov, M.V.; Polozov, A.D. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1983. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702841.

The diffraction model is used to investigate the dependence of integral cross-sections of various processes due to the interaction of deuterons with the diffused-edge nuclei on the form on nucleon-nucleon potential. The sensitivity of cross-sections to the magnitude of nuclear forces between nucleons in deuteron is shown.

47024 **(JINR—E-4-83-684) RPA and the restoration of translation symmetry of rotating nucleus hamiltonian.** Cwiok, S.; Kvasil, J.; Choriev, B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702845.

The translation symmetry of Hamiltonian of rotating nucleus and its relation to the solutions of equations of motion in random phase approximation RPA are investigated. The requirement of restoration of translation symmetry of rotating nucleus Hamiltonian broken by deformed average nucleon field is used for construction of the residual interactions leading to the appearance of the vibrational states near the nucleus yrast line. With these residual interactions the equations of motion in the framework of RPA are solved. The method of extraction of the spurious modes, connected with nucleus center of mass motion in lab. system, from the RPA solutions is proposed. The formulae for energies and structure of the odd parity vibrational states near the yrast line are found.

47025 **(KFTI—82-56) Application of distorted wave method in direct nuclear reactions with polarized particles.** Antuf'ev, Yu.P.; Dejneko, A.S.; Sarana, V.D.; Shlyakhov, N.A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. 21p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702852.

Using the FORTRAN language a program is prepared for ES-1040 computer to calculate angular distributions of differential cross sections, polarization and vector analyzing power direct nuclear reactions of one nucleon transfer (stipping or pick-up) by the method of distorted waves. Simultaneously differential and Roeserford cross sections, their correlation and polarization of elastic scattering of particles in the input and output reaction channels are calculated. Corrections are introduced connected with non-locality of optic potentials and the final radius of action of nuclear forces. Calculations are carried out with double accuracy. The volume of program in terms of bytes is 170 K. The total time of calculation for one variant for nuclei with medium atomic weight is 1.5 min.

47026 **(TRI-PP—83-17) Unresolved theoretical problems.** Vogt, E. (TRIUMF, Vancouver, British Columbia (Canada)). Mar 1983. 10p. (CONF-820357—10). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702855.

From International conference on spin excitations in nuclei; Telluride, CO, USA (25 Mar 1982).

A summary is given of nuclear physics ideas which form the perspective within which the spin excitations in nuclei should be considered. Past work on the nuclear shell model, nuclear collective motion, cluster degrees of freedom and isobaric analogic resonances is reviewed. Indications of the future directions physicists should be taking are discussed. The importance of joining quantum chromodynamics with study of atomic nuclei, and in particular the GT resonance, is highlighted.

47027 **Reply to "Comment on '(p,n) and (n,p) reactions as probes of isovector giant monopole resonances' ".** Auerbach, N.; Bowman, J.D.; Franey, M.A.; Love, W.G. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *C: Nuclear Physics;* **30**: No. 2, 736-737(Aug 1984).

The role of medium corrections in isovector excitations induced by the (p,n) reaction near 120 MeV is examined in light of the preceding Comment by Bauhoff which addresses the issue of making reliable estimates of the sizes of (p,n) cross sections for exciting isovector monopole resonances. To establish confidence in such estimates it is important to examine in parallel the much better understood isobaric analog of the ground state and the relative importance of medium modifications on these monopole transitions. Our examination using both density-independent and density-dependent transition operators supports the assertion of Bauhoff.

47028 **Independent-pair property of condensed coherent fermion pairs and derivation of the IBM quadrupole operator.** Otsuka, T. (Japan Atomic Energy Research Inst., Tokai). *Physics Letters,* [*Section*] *B;* **138**: No. 1-3, 1-5(12 Apr 1984).

It is shown that condensed coherent fermion pairs have a property that each pair can be treated as if it is independent of the other pairs. Utilizing this property, the S and D pairs in deformed nuclei are shown to carry the major fraction of the quadrupole moment. A new fermion-boson mapping method is proposed based on this property. The IBM quadrupole operator is derived miscroscopically.

47029 **Electromagnetic and weak interactions in few-nucleon systems.** Gibson, B.F. (Los Alamos Scientific Lab., NM (USA). Theoretical Div.). *Nuclear Physics* [*Section*] *A;* **416**: 503c-517c(26 Mar 1984). (CONF-830862—).

From 10. international conference on few-body problems in physics; Karlsruhe, F.R. Germany (21 Aug 1983).

Selected problems in electroweak interactions are reviewed. Processes where exact numerical calculations might provide insight are emphasized. 67 refs.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 65400046354, 46978

47030 **(AECL—7759) Radiation fluxes and currents over a plane, circular aperture due to direct contributions from a plane, circular source.** Kushneriuk, S.A.; Lone, M.A. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jun 1982. 36p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84702834.

Formulae are presented for calculating the radial distributions and averages of the fluxes and currents of radiation on a plane, circular aperture due to direct contributions from a plane, uniformly distributed source of radiation of circular shape located co-axially with the aperture. The source emission is either isotropic or of the cosine type. Limiting forms of the fluxes and currents, the mean solid angle of emission from source to aperture and certain identities that arise are also discussed. Some graphical illustrations are given.

47031 (ARL/TR—060, pp 51-54) **X-ray attenuation studies.** Mika, J.F.; Martin, L.J. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

Progress made in developing a facility for measurement of X-ray attenuation coefficients is outlined and results obtained are presented. A collimated broad spectrum X-ray is allowed to pass through a sample before being monochromated by a collimated, energy-dispersive intrinsic germanium detector. Attenuation measurements were performed on samples of pure crystalline silicon.

47032 **(DOE/NBM—4017489) Notes for lectures in China: topics from radiation physics.** Inokuti, M. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017489.

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Topics include problems of radiation physics, stopping power, and mean energy for an ion pair or the W value for a gas. 31 figures are included. (WHK)

47033 **(FEI—1391) Accuracy of the diffusion approximation in neutron leakage calculation and the group method.** Shulepin, V.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84702830.

In the diffusion and $2P_1$-approximations, possibilities of neutron leakage from a non-multiplying plate with a cosine curve source inside are calculated. Taking into account the results obtained, the effect of neutron grouping on the accuracy of calculation of the active zone is considered. The comparison with Ssub(N)-method shows the accuracy of diffusion approximation on the group width in the calculation of the albedo plate, that affects the reflector neutron spectrum and its effectiveness in calculations with different groupping.

47034 **(INDC(EGY)—004/L) Measurements of the total neutron cross-sections of poly- and mono-germanium crystals at neutron energies below 1 eV.** Maayouf, R.M.A.; Abdel-Kawy, A.; Abbas, Y.; Habib, N.; Adib, M.; Hamouda, I. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Dec 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702831.

Total neutron cross-section measurements have been performed for poly and mono-germanium crystals in the energy range from 2 meV-1eV. The measurements were performed using two TOF and a double axis crystal spectrometer installed at the ET-RR-1 reactor. The obtained neutron cross-sections were analyzed using the single level Breit-Wigner formula. The coherent scattering amplitude was determined from the Bragg reflections observed in the total neutron cross-section of Ge and the analysis of its neutron diffraction pattern. The incoherent and thermal diffuse scattering cross-sections of Ge were estimated from the analysis of the total cross-section data obtained for Ge mono-crystal.

47035 **(IRNE—154-1982) Improvement of flux distribution calculation using the extrapolation method of Richardson.** Boeriu, S.; Rapeanu, S.; Mociornita, G.; Badea, E. (Institutul Central de Fizica, Bucharest (Romania)). Sep 1982. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84702832.

Richardson have advanced a method for increasing the accuracy in numerical solving of linear differential equations. So, he proposed several schemes for performing algorithms, in which various approximation parameters are used. It has been proved that a linear combination of this solution under certain circumstances gives a higher accuracy. Starting from these facts the present paper describes the application of the Richardson's method in improving the neutron flux calculation by using the EXTERMINATOR-2-INPR code. The considered benchmark problem has been conceived by D.R.Vondy from ORNL-USA. It consists of solving the multigroup diffusion equations for homogeneous two-dimensional slab. The results obtained show the efficiency of the Richardson method in improving the neutron flux calculation and constitutes a basis for achieving algorithms for other categories of problems.

47036 **(ORNL/TM—9179) Updated users' guide for SAMMY: multilevel R-matrix fits to neutron data using Bayes' equations.** Larson, N.M. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 179p. NTIS, PC E08/MF A01; 1; GPO Dep. File Number DE84017648.

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In 1980 the multilevel multichannel R-matrix code SAMMY was released for use in analysis of neutron data at the Oak Ridge Electron Linear Accelerator. Since that time, SAMMY has undergone significant modifications: (1) User-friendly options have been incorporated to streamline common operations and to protect a run from common user errors; (2) the Reich-Moore formalism has been extended to include an optional logarithmic parameterization of the external R-matrix, for which any or all parameters may be varied; (3) the ability to vary samples thickness, effective temperature, matching radius, and/or resolution-broadening parameters has been incorporated; (4) to avoid loss of information (i.e., computer round-off errors) between runs, the covariance file now includes precise values for all variables; and (5) unused but correlated variables may be included in the analysis. Because of these and earlier changes, the 1980 SAMMY manual is now hopelessly obsolete. This report is intended to be complete documentation for the current version of SAMMY. Its publication in looseleaf form will permit updates of the manual to be made concurrently with updates to the code itself, thus eliminating most of the time lag between update and documentation.

6550 Medical Physics

REFER ALSO TO CITATION(S) 65500046559, 46683

47037 **(AECL—8057) Introduction to radiation protection principles.** White, J.M. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jan 1983. 57p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84702941.

The fundamentals of radiation hazards and their control are outlined. This report is for use by all radiation workers at CRNL and copies are available for all who want one. The purposes of the document are to outline the fundamentals of radiation protection, to describe methods that enable employees to work safely with radiation and to acquaint employees with the CRNL radiation and industrial safety organization.

47038 **(ARL/TR—060, pp 38-41) Accuracy of ICRP dosimetric models.** Wise, N. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

Results of a simulation of the variation of the committed effective dose equivalent per unit intake of aerosols containing ^{238}U, ^{230}Th, ^{226}Ra and ^{210}Pb indicate that if workers differ in their efficiency for depositing inhaled particulates in the lungs then the mean committed dose equivalents given in ICRP publication 30 are accurate to within a factor of 2. However the range is such that the ratio of the largest to the smallest can vary from values near 1 to 770.

47039 **(ARL/TR—060, pp 65-66) Personnel monitoring intercomparison.** Morris, N.D.; Hargrave, N.J. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

Eleven personnel monitoring systems were compared. The performance of the services was wide ranging, with most services having problems in the assessment of large doses of mixed radiations. The doses to which the monitors were exposed ranged from 300 μGy to 10000 μGy.

47040 **(ARL/TR—060, pp 58-59) Calibration and use of kV cassettes.** Young, B.F.; Tingey, D.R.C.; Morris, N.D. Sep 1983. NTIS (US Sales Only), PC A07/MF A01. File Number TI84780547.

In Annual review of research projects 1982.

Three types of kV cassettes used to determine the kV of an X-ray tube have been evaluated. The cassettes were found to be accurate to within +- 3 kV, 2-8 kV and +- 3 kV.

47041 **(CONF-840461—2) Internal emitter limits for iodine, radium and radon daughters.** Schlenker, R.A. (Argonne National Lab., IL (USA)). 15 Aug 1984. Contract W-31-109-ENG-38. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84016243.

From 20. annual meeting of the National Council on Radiation Protection and Measurements; Washington, DC, USA (4 Apr 1984).

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This paper identifies some of the issues which arise in the consideration of the derivation of new limits on exposure to internal emitters. Basic and secondary radiation protection limits are discussed. Terms are defined and applied to the limitation of risk from stochastic effects. Non-stochastic data for specific internal emitters (^{131}I and the radium isotopes) are presented. Emphasis is placed on the quantitative aspects of the limit setting problem. 65 references, 2 figures, 12 tables.

6560 Solid State Physics

REFER ALSO TO CITATION(S) 65600046430

47042 **(N—8424409) Observation of bistability in a Josephson device.** Muhfelder, B.; Johnson, W.W. (Rochester Univ., NY (USA)). Jan 1984. 2p. NTIS, PC A11/MF A01.

A type of bistable behavior not seen before in other Josephson devices is examined. The observed behavior appears to have certain similarities to optical multistability. The output variable of this device (a voltage) will switch spontaneously back and forth between two values that are in the ratio of roughly 5 to 2. This is qualitatively different from the type of bistability conventionally observed in Josephson devices where one of the states is the zero voltage state. These two stable states represent the phase locking of the oscillations of the Josephson junctions to either one or the other of the two lowest order odd half wave resonances of the transmission line. This would then explain the two output voltage states, because the Josephson relation requires that the average frequency and the voltage be in exact proportion.

47043 **Nuclear equation of state from scaling relations for solids.** Rose, J.H.; Vary, J.P.; Smith, J.R. (Ames LaboratoryU.S. Department of Energy, Iowa State University, Ames, Iowa 50011). *Physical Review Letters;* **53**: No. 4, 344-347(23 Jul 1984). Contract W-7405-ENG-82;AC02-82ER40068.

The equation of state of nuclear matter is predicted in analogy with a universal form recently observed to hold for other self-bound systems. This approach was suggested by two findings. First, the spin-isospin—averaged realistic nucleon-nucleon interaction potential is observed to be of the universal form in the region of strong bonding. Secondly, a resulting relation between the cohesive and surface energy is shown to hold for nuclear matter as well as metals and the electron-hole liquid.

6561 Superconductivity

REFER ALSO TO CITATION(S) 65610046206

47044 **(LA-UR—84-2658) Actinides, the narrowwest bands.** Smith, J.L.; Riseborough, P.S. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 17p. (CONF-840876—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016463.

From International conference on valence fluctuations; Koln, F.R. Germany (27 Aug 1984).

A table of elements is shown that demonstrates the crossover from superconductivity to magnetism as well as regions of mixed valence. In particular, the actinides must eventually show 4f-electron like mixed valence, after the 5f-electrons become localized. There also seems to be an adiabatic continuation between heavy fermion and mixed valence behavior.

47045 **(N—8424410) Theory of multistability in Josephson junction devices.** Drummond, P.D.; Muhfelder, B.; Johnson, W.W. (Rochester Univ., NY (USA)). Jan 1984. 3p. NTIS, PC A11/MF A01.

A nonlinear perturbation theory is discussed that includes the nonlinearities of the Josephson equations to zeroth order. A renormalization of the zeroth order solution is then used to remove secular terms from the perturbative solutions. This results in relatively simple input-output relations that are applicable to typical current driven Josephson devices. The renormalization method is fist used to deal with the theory of the onset of capacitive (lightly damped) bistability in single junctions. Next the theory of waveguide superconducting quantum interference devices is described. Optical multistability is obtained in the sense of multistable mode intensities in the waveguide. The state equations depend on the external flux, through the flux quantization relations. A physical picture of the origin of the multistability is presented. The fine scale time evolution of the system was simulated numerically.

47046 **Pairing and charge-density-wave correlations in a one-dimensional electron-exciton model.** Hirsch, J.E.; Scalapino, D.J. (Department of Physics, University of California, San Diego, La Jolla, California 92093). *Physical Review Letters;* **53**: No. 7, 706-709(13 Aug 1984). Contract AT03-83ER45008.

We investigate the pairing, charge-density, and spin-density correlations of a one-dimensional electron-exciton model using Monte Carlo simulations and analytic results from the strong-coupling limit. The zero-frequency susceptibilities characterizing these correlations are studied as a function of band filling and various interaction parameters, particularly retardation. The conditions which are most favorable for a given type of correlation are determined.

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 65700045348, 46913, 46923

47047 **(LA-UR—84-2751) Maxwell's demon, Szilard's engine and quantum measurements.** Zurek, W.H. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 13p. (CONF-8406194—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016779.

From NATO advanced study institute on nonequilibrium quantum statistical mechanics; Santa Fe, NM, USA (1 Jun 1984).

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We propose and analyze a quantum version of Szilard's one-molecule engine. In particular, we recover, in the quantum context, Szilard's conclusion concerning the free energy cost of measurements: $\Delta F \geq$ k/sub B/T1n2 per bit of information.

47048 **(N—84-13985) Baffle system employing reflective surfaces.** Linlor, W.I. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). Dec 1983. 34p. (NASA-TM—84406; A—9480). NTIS, PC A03/MF A01.

Reflective baffles are proposed to reject off-axis light entering a telescope. Toroidal surfaces and adjacent cones are positioned so that off-axis rays make multiple reflections between these two surfaces. Meridional rays are reflected approximately parallel to the entering direction. Skew rays are reflected obliquely, but leave the telescope aperture. The range of incident angles for which these reflections are obtained is approximately 45 deg. A system is described that is designed specifically for the Space Shuttle Infrared Telescope Facility (SIRTF). Because of its reflective properties, the proposed baffle system rejects about 90 deg of the heat load from the SIRTF sunshade that would be absorbed in systems of conventional black baffles.

47049 **New physical interpretation for time in scattering theory.** Pollak, E.; Miller, W.H. (Department of Chemistry, and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review Letters;* **53**: No. 2, 115-118(9 Jul 1984). Contract AC03-76SF00098.

We show that the collision time may be interpreted as the time average of a flux-flux correlation function. This interpretation leads quantum mechanically to a complex time whose real part is identical to the usual definition as provided by F. T. Smith. The imaginary part is identical, in the semiclassical limit, to the imaginary time associated with tunneling.

47050 **Kinetic energy as a perturbation: a convergent algorithm.** Giraud, B.G. (CEA Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette, France). *Journal of Physics A: Mathematical and General;* **17**: No. 5, 969-983(1 Apr 1984).

The potential energy V is placed into the unperturbed Hamiltonian H_0 and the kinetic energy K remains in the perturbation H_1. It is shown that a convergent N/D method, through standard Fredholm determinants, provides suitable matrix elements of an operator such as $H_1 + H_1(E - H)^{-1}H_1$. This confirms that the kinetic energy can be used as a perturbation in the Brillouin-Wigner theory.

6580 Mathematical Physics

REFER ALSO TO CITATION(S) 65800046880

47051 **(LA-UR—84-2336-Rev.) Algorithm for singular decomposition.** Ross, D.C. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 9p. (CONF-840872—14-Rev.). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016488.

From SPIE annual technical symposium; San Diego, CA, USA (19 Aug 1984).

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An iterative algorithm for the singular value decomposition (SVD) of a non-zero m x n matrix M is described and illustrated numerically. Derivations of the algorithm and sufficient conditions for convergence are outlined.

6590 Communication, Education, History, And Philosophy

47052 **(LALP—84-27) Delta: the first pion nucleon resonance - its discovery and applications.** Nagle, D.E. (Los Alamos National Lab., NM (USA)). Jul 1984. Contract W-7405-ENG-36. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017107.

It is attempted to recapture some of the fun and excitement of the pion-scattering work that led to the discovery of what is now called the delta particle. How significant this discovery was became apparent only gradually. That the delta is alive today and thriving at Los Alamos (as well as other places) is described.

70 FUSION ENERGY

47053 **DOE's comprehensive program management plan for magnetic fusion energy. Hearing before the Subcommittee on Energy Research and Production, House of Representatives, Ninety-Eighth Congress, First Session, October 20, 1983.** Washington, DC; Government Printing Office (1984). 197p.

John F. Clarke of the Office of Fusion Energy, Ronald C. Davidson of the Magnetic Fusion Advisory Committee, Leonard Reichle of Ebasco Services Inc. and Stephen O. Dean of Fusion Power Associates testified on DOE's program management of magnetic fusion research development. The DOE witnesses were asked to give an overview of the program's objectives and established milestones, which non-DOE witnesses were asked to evaluate. Dr. Reichle warned that funding is inadequate to guarantee a US capability in commercial fusion energy when it is needed. Dean described the frustrations since 1978 of trying to proceed to the next generation of construction because of budgeting practices and the failure to implement the Magnetic Fusion Act of 1980. An appendix with questions and answers for the record submitted by the four witnesses follows their testimony.

7001 Plasma Research

REFER ALSO TO CITATION(S) 70010047127, 47136, 47192

47054 **(CONF-840370—) US-Japan theory workshop on 3-D MHD studies: proceedings.** Carreras, B.A. (ed.). (Oak Ridge National Lab., TN (USA)). May 1984. Contract AC05-84OR21400. 200p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE84012019.

From US/Japan workshop on 3-D MHD studies; Oak Ridge, TN, USA (19 Mar 1984).

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Abstracts for 12 of the 15 included papers were entered into EDB. Abstracts for the remaining three papers appeared previously in EDB. (MOW)

47055 (CONF-840370—, pp 7-20) **3D algorithm for calculating drift orbits in nonaxisymmetric toroidal devices.** Hanatani, K.; Uo, K. (Kyoto Univ., Japan). May 1984. NTIS, PC A09/MF A01. File Number TI84012019.

From US/Japan workshop on 3-D MHD studies; Oak Ridge, TN, USA (19 Mar 1984).

A three-dimensional (3D) interpolation technique for computing guiding-center drift orbits in nonaxisymmetric toroidal magnetic devices is described. The new technique, named two-level interpolation scheme, uses a simple algorithm which splits given field quantities into symmetric (2D) and asymmetric (3D) parts. The interpolation scheme allows a fast and accurate drift orbits computation and also provides a direct means to examine the effects of symmetry-breaking perturbation as a part of the numerical procedure. The technique has been applied to study the toroidal drift of the particles in a vacuum heliotron field. It was found that the asymmetric part of the drift shows a vortex structure and this vortex reduces the net vertical drift in the peripheral region of the magnetic surface. A strong reduction in the net vertical drift occurs even near the magnetic axis when the magnetic axis is shifted inward by applying vertical field. The presence of the drift vortex is attributed to the absence of toroidal field coils in the heliotron field studied. An implication of the drift vortex on the diffusive and nondiffusive particle losses from the heliotron plasma is also commented.

47056 (CONF-840370—, pp 34-41) **Non-linear calculations of m = 1 interchange mode in heliotron E.** Wakatani, M.; Shirai, H. (Kyoto Univ., Japan). May 1984. NTIS, PC A09/MF A01. File Number TI84012019.

From US/Japan workshop on 3-D MHD studies; Oak Ridge, TN, USA (19 Mar 1984).

In the heliotron with large rotational transform, Iota(a) $\sim$ 2, the dominant stabilizing mechanism against MHD instabilities is shear. The linear MHD stability of the heliotron configuration was studied against the low n pressure-driven modes both for the cylindrical and the toroidal configuration, where n is a toroidal mode number. It is found that (i) the equilibrium averaged beta limit exceeds 7% since both Iota and the aspect ratio, R/a, is large, and (ii) the stability beta limit depends on the pressure profile and broad profiles give large stability margin.

47057 (CONF-840370—, pp 88-100) **Nonlinear MHD simulations of the Spheromak and the reversed field pinch.** Mirin, A.A.; O'Neill, N.J.; Sgro, A.G. (Lawrence Livermore National Lab., CA; Los Alamos National Lab., NM). May 1984. NTIS, PC A09/MF A01. File Number TI84012019. Contract W-7405-ENG-48.

From US/Japan workshop on 3-D MHD studies; Oak Ridge, TN, USA (19 Mar 1984).

MHD simulations applicable to both the CTX gun-injected Spheromak at Los Alamos National Laboratory and to the various Reversed Field Pinches (e.g. ZT40 at LANL) are presented. The evolution of the Spheromak is simulated using the three-dimensional, finite-beta, compressible, nonlinear, resistive MHD code TEMCO. The code uses cylindrical coordinates (r,phi,z) and hence is applicable to both cylindrical and toroidal geometries. The effect of Hall terms on resistive interchange modes in a Reversed Field Pinch is studied using the cylindrical, linear, compressible, finite-beta initial value code ODRIC. Extensions of this work to three dimensions will be presented at a later date.

47058 (CONF-840370—, pp 101-112) **Finite element method and its application to 3D dynamic system.** Aizawa, M.; Kawakami, I. (Nihon Univ., Tokyo, Japan). May 1984. NTIS, PC A09/MF A01. File Number TI84012019.

From US/Japan workshop on 3-D MHD studies; Oak Ridge, TN, USA (19 Mar 1984).

A numerical method for solving a system of 3D-MHD equations is proposed. The method is based on and formulated with the finite element method (FEM) with elements in motion, that is, arbitrary Lagrangian and Eulerian (ALE) method. This method is called FEMALE.

47059 (CONF-840370—, pp 138-148) **Total dereduction of the reduced equations.** Izzo, R.; Monticello, D.; DeLucia, J. (Princeton Univ., NJ). May 1984. NTIS, PC A09/MF A01. File Number TI84012019. Contract AC02-76CH03073.

From US/Japan workshop on 3-D MHD studies; Oak Ridge, TN, USA (19 Mar 1984).

We have recently reported on the expansion of the Magnetohydrodynamics (MHD) equations to 4th order in the aspect ratio. This high order expansion (2 orders past leading order) was necessary in order to calculate correctly the stability and nonlinear evolution of the internal kink. We report here on the expansion of the MHD equations to 5th order in the aspect ratio.

47060 (CONF-840370—, pp 158-173) **Nonlinear evolution of external kink mode in tokamak and comment on resistive internal kink mode.** Tsunematsu, Toshihide; Kurita, Gen-ichi; Azumi, Masafumi; Takizuka, Tomonori; Takeda, Tatsuoki. (Japan Atomic Energy Research Inst., Tokai, Ibaraki). May 1984. NTIS, PC A09/MF A01. File Number TI84012019.

From US/Japan workshop on 3-D MHD studies; Oak Ridge, TN, USA (19 Mar 1984).

A model of the resistive free boundary plasma is described and the validity of this model as the first step to study the role of the free boundary mode in the major disruption process is shown. A study was made of the structure of the external kink mode as the candidate of the unstable free boundary mode in the linear theory and the nonlinear evolution of the mode to estimate the level of the saturation.

47061 (CONF-840370—, pp 174-191) **Calculations in toroidal geometry with full MHD equations.** Charlton, L.A.; Carreras, B.A.; Holmes, J.A.; Hicks, H.R.; Lynch, V.E. (Oak Ridge National Lab., TN). May 1984. NTIS, PC A09/MF A01. File Number TI84012019.

From US/Japan workshop on 3-D MHD studies; Oak Ridge, TN, USA (19 Mar 1984).

A fully toroidal formalism has been developed. This approach uses the full MHD equations with no ordering assumptions. The fluid is, however, assumed to be incompressible. It can be used to study either ideal or resistive modes. This formalism has been used to construct the computer code FAR, which is linear and fully-implicit. The fully-implicit nature of the numerics allows extremely fast calculations, as will be discussed below. Detailed comparisons for $n = 1$ modes have been made with the computer code RST, which uses an ordering formalism due to Strauss. All results presented in this paper are linear. This work, however, is viewed as a first step toward nonlinear calculations. Work, in fact, is well underway to be able to do nonlinear studies.

47062 (CONF-840370—, pp 68-87) **Three-dimensional MHD in the reversed-field pinch.** Schnack, D.D.; Baxter, D.C.; Caramana, E.J.; Nebel, R.A.; Gerwin, R.A. (Science Applications, Inc., La Jolla, CA; Los Alamos National Lab., NM). 1984. NTIS, PC A09/MF A01. File Number TI84012019. Contract AC03-83ER53150.

From US/Japan workshop on 3-D MHD studies; Oak Ridge, TN, USA (19 Mar 1984).

The physical and computational problems are similar to those encountered in the simulation of turbulent hydrodynamic flows. Accurate and efficient methods have been developed for the solution of these problems. These spectral methods are based on the use of the Fast Fourier Transform (FFT), which allows the convolution sums to be evaluated in $O(N\ln_2 N)$ operations, as opposed to $O(N^2)$ operations for direct summation. This allows many modes to be used in the simulation. In this paper we describe codes based on these methods, and briefly present some results.

47063 (DOE/DP/40171—2) **Plasma shifts of C VI Lyman lines to shorter wavelengths. Final report, November 4, 1981-September 30, 1983.** Griem, H.R. (Maryland Univ., College Park (USA). Lab. for Plasma and Fusion Energy Studies). Jul 1984. Contract AS08-82DP40171. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017412.

The first two years of this ongoing research program were devoted to experimental observations of shifts and widths of hydrogenic ion lines emitted by very dense plasmas. This search is an essential step in the general study of the properties of bound states of multiply charged ions in dense plasmas. This research is of importance in a number of areas, notably equilibrium statistical mechanics (equation of state), plasma radiation physics (energy transport and diagnostics) and calibration of wavelengths in the extreme vacuum uv region ($10\ \text{A} < \lambda < 200\ \text{A}$). In the latter case, the wavelengths of lines from one-electron ions are generally accepted to be well known theoretically and are considered as standards for plate calibration. The question nevertheless arises whether or not significant changes in wavelength can occur, e.g., in low-inductance sparks or laser produced plasma which are often used as line sources.

47064 (DOE/ET/52040—T21) **CTR plasma engineering studies. Annual progress report, 1 November 1983-30 October 1984.** Miley, G.H. (Illinois Univ., Urbana (USA). Fusion Studies Lab.). 1984. Contract AC02-76ET52040. 148p. (COO—2218-307). NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84017447.

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This report covers research on the following topics: (1) transport in compact tori, (2) bremsstrahlung energy deposition in first wall materials, (3) Coulombic energy transfer collisions, (4) magnetic helicity injection study, (5) blankets for tritium catalyzed deuterium fusion reactors, (6) exploratory studies of applications of optimal control theory, (7) design of a burn dynamic experiment, (8) alpha driven low frequency fast magnetosonic wave microinstability in tandem mirror, (9) fusion product heating and confinement in a tandem mirror, and (10) velocity-space particle loss in field reversed configurations.

47065 (DOE/ET/53003—1) **Effect of alpha particles on the stability of Elmo Bumpy Torus (EBT) reactor. Final report.** Wojtowicz, D.; Kammash, T. (Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering). 1984. Contract AC02-76ET53003. 34p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017266.

The macroscopic stability of an ignited EBT reactor is investigated by studying the effects of the alpha particles generated by the Deuterium-Tritium (D-T) fusion reaction on the background interchange mode, the interacting interchange mode, and the high-frequency compressional Alfven and coupled modes. A fluid description is used for the background plasma while a kinetic treatment is utilized for the hot electron species and the alpha particles. It is shown that the alphas tend to mildly destabilize the interacting interchange while stabilizing the background interchange due to their sizable Larmor radii. The destabilization is most pronounced when the beta of the alpha particles in highest, i.e., at birth, and recovery of stabilization takes place as these particles slow down toward thermalization. It is also shown that the alphas completely stabilize the high frequency modes so that it can safely be concluded that fusion alphas present no detrimental effects on the stability of an EBT reactor that possesses an appropriate hot electron ring for macroscopic stability.

47066 (DOE/ET/53016—T4) **High-beta tokamak research. Annual progress report, August 1, 1983-July 30, 1984.** Navratil, G.A. (Columbia Univ., New York (USA)). Aug 1984. Contract AC02-76ET53016. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016470.

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Our main research objectives during the past year fell into four areas: (1) construction and initial operation of the new tokamak, HBT; (2) further numerical modeling of the Torus II experimental equilibria using the PPPL equilibrium and stability codes; (3) diagnostic development; and (4) ICRF antenna coupling calculation in 2D and rf current drive.

47067 (DOE/ET/53016—T5) **High-beta plasma theory. Annual progress report.** Chu, C.K. (Columbia Univ., New York (USA)). Aug 1984. Contract AC02-76ET53016. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016471.

Summaries of research during this period are given. No significant information is included. (MOW)

47068 **(DOE/ET/53051—69) Discharge initiation experiments in the Tokapole II tokamak.** Shepard, D.A. (Wisconsin Univ., Madison (USA)). Jun 1984. Contract AC02-76ET53051. 114p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84017345.

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Experiments in the Tokapole II tokamak demonstrate the benefits of high density (n/sub e//$n_0 \geqq 0.01$) preionization by reducing four quantities at startup: necessary toroidal loop voltage (V_1) (50%), volt-second consumption (40 to 50%), impurity radiation (25 to 50%), and runaway electron production (~ 80 to 100%). A zero-dimensional code models the loop voltage reduction dependence on preionization density and predicts a similar result for reactor scale devices. The code shows low initial resistivity and a high resistivity time derivative contribute to loop voltage reduction. The power balance of the ECR plasma in a toroidal-field-only case was studied. Langmuir probes and impurity doping were used. The vertical electric field (E/sub v/) and current (I/sub v/), which result from curvature drift, were measured (E/sub v/ ~ 10 V/cm and I/sub v/ ~ 50 Amps) and exceeded expected values for the bulk electron temperature (~ 10 eV). A series of experiments with external windings to simulate field errors perpendicular to the toroidal field was done. The results imply that an error field of 0.1% of the toroidal field is deleterious to ECR plasma density.

47069 **(DOE/ET/53051—70) Effects of q and high beta on tokamak stability.** Brickhouse, N.S.; Callen, J.D.; Dexter, R.N.; Graessle, D.E.; Kortbawi, D.; Moyer, R.A.; Osborne, T.H.; Prager, S.C.; Sarff, J.S.; Sprott, J.C. (Wisconsin Univ., Madison (USA); Columbia Univ., New York (USA). Plasma Physics Lab.). Aug 1984. Contract AC02-76ET53051. 11p. (CONF-840910—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016650.

From 10. international conference on plasma physics and controlled nuclear fusion research; London, UK (12 Sep 1984).

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In the Columbia University Torus II tokamak plasmas have been studied with volume averaged toroidal beta values as high as 15%. Experimental equilibria have been compared with a 2D free boundary MHD equilibrium code PSEC. The stability of these equilibria has been computed using PEST, the predictions of which are compatible with an observed instability in Torus II which may be characterized as a high toroidal mode number ballooning fluctuation. In the University of Wisconsin Tokapole II tokamak disruptive instability behavior is investigated, with plasma able to be confined on closed magnetic surfaces in the scrape-off region, as the cylindrical edge safety factor is varied from q ~ 3 to q ~ 0.5. It is observed that at q/sub a/ ~ 3 major disruption activity occurs without current terminations, at q/sub a/ $\leqq$ 2 well-confined plasmas are obtained without major disruption, and at q/sub a/ ~ 0.5 only partial reconnection accompanies minor disruptions.

47070 **(LA—10183-M) Preliminary user's guide for BIGONE on the Cray.** Snell, C.; Kwan, T. (Los Alamos National Lab., NM (USA)). Jul 1984. Contract W-7405-ENG-36. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017075.

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BIGONE is an electromagnetic particle-in-cell code used to simulate behavior of a collisionless plasma in one spatial dimension and three velocity components. Unusual features include the ability to treat large systems with general initial and boundary conditions. Extensive diagnostics and analysis capabilities are also provided. This manual summarizes all changes made since the previous CDC-7600 version of the code, defines the Namelist input variables, and gives complete instructions for running the Cray version.

47071 **(LA-UR—84-2690) Theoretical studies of field-reversed configurations (FRCs) and experimental study of the FRC during translation.** Siemon, R.E.; Armstrong, W.T.; Chrien, R.E.; Klingner, P.L.; Linford, R.K.; McKenna, K.F.; Rej, D.J.; Schwarzmeier, J.L.; Sgro, A.; Sherwood, E.G. (Los Alamos National Lab., NM (USA); JAYCOR, San Diego, CA (USA); New York Univ., NY (USA); Lawrence Livermore National Lab., CA (USA); Cornell Univ., Ithaca, NY (USA)). Aug 1984. Contract W-7405-ENG-36. 13p. (CONF-840910—13). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016467.

From 10. international conference on plasma physics and controlled nuclear fusion research; London, UK (12 Sep 1984).

Theoretical studies of FRC stability and tranport are summarized. Finite Larmor radius theories are shown to be unreliable for explaining the experimentally observed stability to tilting. Control of the n=2 rotational instability has been demonstrated in 2-dimensional hybrid-code simulations, and the stability appears to be described within MHD if the nearly square equilibria that result from quadrupole fields are taken into account. Simulations of the lower-hybrid-drift instability in parameter regimes relevant to experiments show good agreement with a nonlocal theory of the instability. A 1.5-dimensional transport code shows agreement with the energy confinement time but disagreement with the flux loss time observed in FRX-C. The process of FRC translation in which the plasma is formed, translated into a dc solenoid, and trapped by magnetic mirrors has been studied in the FRX-C/T experiment.

47072 **(N—84-12911) Atomic processes in hot dense plasma.** Kagawa, T.; Kato, T.; Watanabe, T. (Nagoya Univ. (Japan)). Aug 1983. 45p. (IPPJ-AM—31). NTIS, PC A03/MF A01.

Central field models and the theoretical analyses for some atomic processes in hot, dense, plasmas are reviewed. The qualitative trends of the density- and temperature-dependent properties of plasma particles, which could be used for plasma diagnostics, are described.

47073 **(N—84-12913) Bibliography on atomic processes in hot dense plasmas.** Kato, T.; Kagawa, T.; Karashima, S.; Miyanaga, N.; Tawara, H.; Yamaguchi, N.; Yamamoto, K.; Yonei, K. (Nagoya Univ. (Japan)). Aug 1983. 48p. (IPPJ-AM—29). NTIS, PC A03/MF A01.

Information on atomic processes in hot dense plasmas which are connected with inertial confinement fusion and astrophysics was compiled from 114 records stored in the HIDENS data base. Energy level, f or A value, bound free transition, free-free transition, collision, and stopping power are listed along with the bibliographic citations fo each report.

47074 **(N—84-12916) Rotating and propagating LIB stabilized by self-induced magnetic field.** Murakami, H.; Aoki, T.; Kawata, S. (Nagoya Univ. (Japan)). Aug 1983. 29p. (IPPJ—640). NTIS, PC A03/MF A01.

Rotating motions of propagating LIB are analyzed in order to suppress the instability of mixed mode of the Kelvin-Helmholtz, tearing and sausage types by the action of a self-induced magnetic field in the axial direction. The beams are assumed to be charge-neutralized but not current-neutralized. The steady-state solutions of propagating LIB with rotations are numerically obtained first. Through the dispersion relation with respect to the ikonal type of perturbations which are added to the steady-state solutions, the growth rates of instabilities appearing in LIB are obtained. It is concluded that if the mean rotating velocity of LIB is comparable to the propagation velocity, in other words, if the induced magnetic field intensity in the axial direction is comparable to the magnetic field intensity in the azimuthal direction, the macro-instability disappears in the propagating ion beam.

47075 **(ORNL/TM—9182) Zero-current, high beta stellarator equilibria with rotational transform profile control.** Carreras, B.A.; Hicks, H.R.; Holmes, J.A.; Lynch, V.E.; Neilson, G.H. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016635.

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High beta, zero-current equilibria for a stellarator device are calculated using the averaging method. It is found that, by shaping the vertical field, the rotational transform can be controlled in an approximate way as beta is increased. At the same time, the Pfirsch-Schlueter currents are reduced - with no modification of the magnetic well. This permits access to the high beta regime with more favorable rotational transform profiles. Results are presented for the Advanced Toroidal Facility (ATF) device.

47076 **(ORNL/TM—9193) Monte Carlo studies of transport in stellarators.** Fowler, R.H.; Rome, J.A.; Lyon, J.F. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017633.

Transport is studied in toroidal geometry by integrating the guiding-center equations in magnetic coordinates and simulating collisions with a Monte Carlo collision operator. The effects of the ambipolar electric field on diffusion losses are determined for model magnetic fields and the correct magnetic field of the Advanced Toroidal Facility (ATF-1) stellarator. Comparisons are made of the computed diffusion coefficients and the theoretically predicted values.

47077 **(ORNL/TM—9206) Stochastic particle diffusion in velocity space for EBT-S.** Chen, G.L.; Owen, L.W.; Batchelor, D.B.; Hedrick, C.L. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017649.

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Nonadiabatic changes of the magnetic moment μ in the ELMO Bumpy Torus-Scale (EBT-S) have been studied both analytically and numerically. Simple forms of $\Delta\mu$ and the gyrophase change $\Delta\theta$ were obtained, permitting the changes in these quantities to be studied using an iteration mapping. The mapping results show stochastic behavior for particles having high energy and low initial μ. Otherwise, superadiabatic motion appears. The stochastic diffusion coefficient for the variation of μ was measured numerically by mapping and was also calculated from quasi-linear theory. The results are shown to agree well in the stochastic region. For high-energy particles, the diffusion in μ due to nonadiabaticity can be comparable to collisional diffusion when stochastic motion occurs in EBT-S.

47078 **(ORNL/TM—9230) Background calculations for the measurement of the ion temperature in a deuterium plasma.** Alsmiller, R.G. Jr.; Santoro, R.T.; Manneschmidt, J.F.; Barnes, J.M. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016546.

The ion temperature of a deuterium plasma with a Maxwellian distribution may be determined by measuring the transmission of the D-D neutrons, i.e., neutrons produced by the reaction $D + D \rightarrow n + {}^3He$, through liquid oxygen. In practice the measurement requires both collimation and shielding to ensure that the attenuation of only those neutrons emitted directly from the plasma is measured. Calculated results are presented of the collimation and shielding required to reduce the background so that the ion temperature may be measured. The geometric configuration used in the calculations is that of the Impurity Studies Experiment (ISX) at the Oak Ridge National Laboratory, but the results will provide insight into the application of the measurement method at other plasma facilities. Results are presented for D-D plasma temperatures of 2, 6, and 10 keV and for two sizes of NE-213 detectors. It is concluded that the counting rates are too low to make the measurement feasible at ISX.

47079 **(PPPL—2076) Saturation of drift instabilities by electron dynamics.** Smith, R.A.; Krommes, J.A.; Lee, W.W. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1984. Contract AC02-76CH03073. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017129.

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An analytical explanation is provided for phenomena observed in gyrokinetic particle simulations, which were used to study the nonlinear evolution of the universal instability. The nonlinear E x B advection of nearly resonant electrons is related to the deactivation of the instability mechanism, leading to oscillations of the perturbation amplitude around a nonzero saturated level. An equivalent description is given in terms of nonresonant mode coupling. A self-consistent evolution equation for the amplitude is obtained for the case where this mechanism predominates, and is successfully compared to the gyrokinetic simulations.

47080 **(PPPL—2128) Efficiency of current drive by fast waves.** Karney, C.F.F.; Fisch, N.J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1984. Contract AC02-76CH03073. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017064.

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The Rosenbluth form for the collision operator for a weakly relativistic plasma is derived. The formalism adopted by Antonsen and Chu can then be used to calculate the efficiency of current drive by fast waves in a relativistic plasma. Accurate numerical results and analytic asymptotic limits for the efficiencies are given.

47081 **(PPPL—2130) Optimal oscillation-center transformations.** Dewar, R.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1984. Contract AC02-76CH03073. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017067.

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A variational principle is proposed for defining that canonical transformation, continuously connected with the identity transformation, which minimizes the residual, coordinate-dependent part of the new Hamiltonian. The principle is based on minimization of the mean-square generalized force. The transformation reduces to the action-angle transformation in that part of the phase space of an integrable system where the orbit topology is that of the unperturbed system, or on primary KAM surfaces. General arguments in favor of this definition are given, based on Galilean invariance, decay of the Fourier spectrum, and its ability to include external fields or inhomogeneous systems. The optimal oscillation-center transformation for the physical pendulum, or particle in a sinusoidal potential, is constructed.

47082 **(PPPL—2131) Resistive ballooning modes in an axisymmetric toroidal plasma with long mean-free path.** Connor, J.W.; Chen, L. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Euratom/UKAEA Fusion Association, Abingdon (UK). Culham Lab.). Aug 1984. Contract AC02-76CH03073. 33p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017062.

Tokamak devices normally operate at such high temperatures that the resistive fluid description is inappropriate. In particular, the collision frequency may be low enough for trapped particles to exist. However, on account of the high conductivity of such plasmas, one can identify two separate scale lengths when discussing resistive ballooning modes. By describing plasma motion on one of these, the connection length, in terms of kinetic theory the dynamics of trapped particles can be incorporated. On the resistive scale length, this leads to a description in terms of modified fluid equations in which trapped particle effects appear. The resulting equations are analyzed and the presence of trapped particles is found to modify the stability properties qualitatively.

47083 **(PPPL—2132) Current ramp-up with rf waves in a tokamak.** Fisch, N.J.; Karney, C.F.F. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1984. Contract AC02-76CH03073. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017068.

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The circuit equations for current-drive in a start-up or ramp-up plasma are derived by finding appropriate response functions in the presence of an electric field. The effect of arbitrary wave-induced fluxes on runaway production and current generation can

then be determined. An interpretation of the rather remarkable PLT ramp-up efficiencies, difficult to explain using the steady-state efficiency, is now possible. A parameter regime, available also on reactor-grade devices, is identified wherein quick ramp-up by lower-hybrid waves may be efficient.

47084 **(PPPL—2134) Observation of finite-β MHD phenomena in tokamaks.** McGuire, K.M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1984. Contract AC02-76CH03073. 49p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017072.

Stable high-beta plasmas are required for the tokamak to attain an economical fusion reactor. Recently, intense neutral beam heating experiments in tokamaks have shown new effects on plasma stability and confinement associated with high beta plasmas. The observed spectrum of MHD fluctuations at high beta is clearly dominated by the n = 1 mode when the q = 1 surface is in the plasma. The m/n = 1/1 mode drives other n = 1 modes through toroidal coupling and n > 1 modes through nonlinear coupling. On PDX, with near perpendicular injection, a resonant interaction between the n = 1 internal kink and the trapped fast ions results in loss of beam particles and heating power. Key parameters in the theory are the value of q_0 and the injection angle. High frequency broadband magnetic fluctuations have been observed on ISX-B and D-III and a correlation with the deterioration of plasma confinement was reported. During enhanced confinement (H-mode) discharges in divertor plasmas, two new edge instabilities were observed, both localized radially near the separatrix. By assembling results from the different tokamak experiments, it is found that the simple theoretical ideal MHD beta limit has not been exceeded. Whether this represents an ultimate tokamak limit or if beta optimized configurations (Dee- or bean-shaped plasmas) can exceed this limit and perhaps enter a second regime of stability remains to be clarified.

47085 **(PPPL—2139) Waves in plasmas: some historical highlights.** Stix, T.H. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1984. Contract AC02-76CH03073. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017069.

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To illustrate the development of some fundamental concepts in plasma waves, a number of experimental observations, going back over half a century, are reviewed. Particular attention is paid to the phenomena of dispersion, collisionfree damping, finite-Larmor-radius and cyclotron and cyclotron-harmonic effects, nonlocal response, and stochasticity. One may note not only the constructive interplay between observation and theory and experiment but also that major advances have come from each of the many disciplines that invoke plasma physics as a tool, including radio communication, astrophysics, controlled fusion, space physics, and basic research.

47086 **(UCID—20051) Comparison of measured and computed plasma loading resistance in the tandem mirror experiment-upgrade (TMX-U) central cell.** Mett, R.R. (Lawrence Livermore National Lab., CA (USA)). 1 Aug 1984. Contract W-7405-ENG-48. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017604.

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The plasma loading resistance vs density plots computed with McVey's Code XANTENA1, agree well with experimental measurements in the TMX-U central cell. The agreement is much better for frequencies where $\omega/\omega/\text{sub ci}/ < 1$ than for $\omega/\omega/\text{sub ci}/ \geq 1$.

47087 **(UCRL—90396-Rev.1) Thermal barrier confinement experiments in TMX-U tandem mirror. Revision 1.** Simonen, T.C.; Allen, S.L.; Baldwin, D.E.; Casper, T.A.; Clauser, J.F.; Coensgen, F.H.; Cohen, R.H.; Correll, D.L.; Cummins, W.F.; Damm, C.C. (Lawrence Livermore National Lab., CA (USA)). 26 Jul 1984. Contract W-7405-ENG-48. 14p. (CONF-840910—8-Rev.1). NTIS, PC A02/MF A01; GPO Dep. File Number DE84017029.

From 10. international conference on plasma physics and controlled nuclear fusion research; London, UK (12 Sep 1984).

In our recent experiments on the TMX-U thermal-barrier device, we achieved the end plugging of axial ion losses up to a central cell density of n/sub c/ = 6 x 10^{13} cm^{-3}. During lower density experiments, we measured the axial potential profile characteristic of a thermal barrier and found an ion-confining potential greater than 1.5 kV and a potential depression of 0.45 kV in the barrier region. The average beta of hot end plug electrons has reached 15% and of hot central cell ions has reached 6%. In addition, we heated deuterium ions in the central cell with ICRF to an average perpendicular energy of 2 keV. During strong end plugging at low density (7 x 10^{11} cm^{-3}), the axial ion confinement time tau/sub parallel to/ reached 50 to 100 ms while the nonambiopolar radial ion confinement time tau/sub perpendicular to/ was 14 ms - independent of end plugging. Electrically floating end walls doubled the radial ion confinement time. At higher densities and lower potentials, tau/sub parallel to/ was 6 to 12 ms and tau/sub perpendicular to/ exceeded 100 ms.

47088 **Radial transport reduction in tandem mirrors using end-wall boundary conditions.** Hooper,Jr., E.B.; Baldwin, D.E.; Fowler, T.K.; Kane, R.J.; Turner, W.C. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physics of Fluids;* **27**: No. 9, 2264-2267(Sep 1984). Contract W-7405-ENG-48.

Results from the Tandem Mirror Experiment-Upgrade (TMX-U) demonstrate that radial transport in the plasma volume can be affected by the boundary conditions at the end wall. Measurements in which end-wall plates, mapping to the plasma core, are switched from floating to grounded during plugging operation demonstrate that this floating increases the build-up rate of the central cell plasma (by increasing the radial confinement time), steepens the core density profile, and affects the plasma throughout the entire cross section.

47089 **Electron transport in the ELMO Bumpy Torus in the low collision frequency limit.** Hastings, D.E. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physics of Fluids;* **27**: No. 9, 2272-2286(Sep 1984). Contract W-7405-ENG-26.

The electron neoclassical transport coefficients are calculated in a bumpy torus for the low collisionality regime. The electron radial drift is calculated as a function of the plasma position, as well as the poloidal electric field, which is determined self-consistently. A bounce-averaged differential collisional operator is used and the results are compared to previous treatments using a BGK operator.

47090 **Collisional transport of momentum in axisymmetric configurations.** Hogan, J.T. (Fusion Energy Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physics of Fluids;* **27**: No. 9, 2308-2312(Sep 1984). Contract W-7405-ENG-26.

Calculations of the cross-field transport of toroidal momentum are presented for the collision-dominated regime in devices with an axisymmetric magnetic configuration. Intended as a point of reference for more complex calculations of transport in the low collision frequency regime, the development treats the case of pure toroidal flow and closely parallels previous calculations of collisional thermal conductivity in tokamaks. Certain counter-intuitive features of previous fluid-regime calculations of momentum diffusion are removed, and the contribution of viscous heating to the ion energy balance is discussed. A relation between internal disruptions (sawtooth oscillations) and momentum transport is proposed.

47091 **Harmonic generation and parametric decay in the ion-cyclotron frequency range.** Skiff, F.; Wong, K.L.; Ono, M. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Physics of Fluids;* **27**: No. 9, 2205-2208(Sep 1984). Contract AC02-76CH03073.

Harmonic generation and parametric decay are examined in a toroidal ACT-1 plasma using electrostatic plate antennas. The harmonic generation, which is consistent with sheath rectification, is sufficiently strong that the nonlinearly generated harmonic modes themselves decay parametrically. Resonant and nonresonant para-

metric decay of the second harmonic are observed and compared with uniform pump theory. Resonant decay of lower-hybrid waves into lower-hybrid waves and slow ion-cyclotron waves is seen for the first time. Surprisingly, the decay processes are nonlinearly saturated, indicating absolute instability.

47092 **Laser-induced profile modification: Effect of electron response.** Aldrich, C.H.; Jones, R.D.; Lee, K. (Applied Theoretical Physics Division, University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **27**: No. 9, 2351-2360(Sep 1984).

Physical processes which occur at the critical surface such as resonance absorption and scattering of the incident laser light are very sensitive to the exact form of the laser induced density profile. The presence of "overdense bumps" in density profiles has been seen experimentally and calculated theoretically using a simple isothermal model. These structures are important, in that they could, in an experimental situation, reflect a significant amount of light before it reaches the critical surface and considerably affect the physics occuring within a laser pellet target. A generalization of a previous calculation by using an arbitrary equation of state (density response of the electrons to the electrostatic potential phi) of the form rho = rho(phi) is obtained. In particular, two models for the electronic response (one including the effects of the presence of trapped electrons within the overdense shock structures) calculating the resulting effect on the produced density profiles are investigated. Qualitatively, it is found that the presence of overdense structures and their one-dimensional stability within an underdense plasma is unaffected by the more general electronic response. Conditions for the existence of these structures are discussed and a detailed comparison with full particle in cell (PIC) code simulations is made, emphasizing the trapped electron model where excellent agreement is obtained.

47093 **Thermal-barrier production and indentification in a tandem mirror.** Grubb, D.P.; Allen, S.L.; Casper, T.A.; Clauser, J.F.; Coensgen, F.H.; Correll, D.L.; Cummins, W.F.; Damm, C.C.; Foote, J.H.; Goodman, R.K.; Hill, D.N.; Hooper,Jr., E.B.; Hornady, R.S.; Hunt, A.L.; Kerr, R.G.; Leppelmeier, G.W.; Marilleau, J.; Moller, J.M.; Molvik, A.W.; Nexsen, W.E.; Pickles, W.L.; Porter, G.D.; Poulsen, P.; Silver, E.H.; Simonen, T.C.; Stallard, B.W.; Turner, W.C.; Hsu, W.L.; Yu, T.L.; Barter, J.D.; Christensen, T.; Dimonte, G.; Romesser, T.W.; Ellis, R.F.; James, R.A.; Lasnier, C.J.; Berzins, L.V.; Carter, M.R.; Clower, C.A.; Failor, B.H.; Falabella, S.; Flammer, M.; Nash, T. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physical Review Letters;* **53**: No. 8, 783-786(20 Aug 1984). Contract W-7405-ENG-48.

In thermal-barrier experiments in the tandem mirror experiment upgrade axial confinement times of 50 to 100 ms have been achieved. During enhanced confinement we measured the thermal-barrier potential profile using a neutral-particle-beam probe. The experimental data agree qualitatively and quantitatively with the theory of thermal-barrier formation in a tandem mirror.

47094 **Resonance localization and poloidal electric field due to cyclo- tron wave heating in tokamak plasmas.** Hsu, J.Y.; Chan, V.S.; Harvey, R.W.; Prater, R.; Wong, S.K. (GA Technologies Incorporated, San Diego, California 92138). *Physical Review Letters;* **53**: No. 6, 564-567(6 Aug 1984). Contract AT03-84ER53158.

The perpendicular heating in cyclotron waves tends to pile up the resonant particles toward the low magnetic field side with their banana tips localized to the resonant surface. A poloidal electric field with an E x B drift comparable to the ion vertical drift in a toroidal magnetic field may result. With the assumption of anomalous electron and neoclassical ion transport, density variations due to wave heating are discussed.

47095 **Observation of lower-hybrid current drive at high densities in the Alcator C tokamak.** Porkolab, M.; Schuss, J.J.; Lloyd, B.; Takase, Y.; Texter, S.; Bonoli, P.; Fiore, C.; Gandy, R.; Gwinn, D.; Lipschultz, B.; Marmar, E.; Pappas, D.; Parker, R.; Pribyl, P. (Massachusetts Institute of Technology, Plasma Fusion Center, Cambridge, Massachusetts 02139). *Physical Review Letters;* **53**: No. 5, 450-453(30 Jul 1984). Contract AC02-78ET51013.

A quasi-steady-state lower-hybrid current-drive operation is demonstrated in the Alcator C tokamak at densities up to n-bar/sub e/≃1 x 10^{14} cm^{-3}. The current-drive efficiency is measured experimentally over a wide range of densities and magnetic fields. The radial distribution of high-energy x rays indicates that the current-carrying electrons peak near the plasma axis.

47096 **MCNP capabilities for fusion neutronics applications.** Thompson, W.L. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **46**: 274-275(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47097 **Building a data base for a tokamak reactor: Five years of experiments with noncircular plasmas in Doublet III.** Wesley, J.C. (GA Technologies, P.O. Box 81608, San Diego, CA 92138). *Transactions of the American Nuclear Society;* **46**: 185-186(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47098 **ASDEX divertor tokamak results of significance for large fusion experiments.** Karger, F. (Max Planck Institut fur Plasmaphysik D-8046 Garchin). *Transactions of the American Nuclear Society;* **46**: 185(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47099 **TMX-U thermal barrier tandem mirror experiments.** Coensgen, F.H. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, CA 94550). *Transactions of the American Nuclear Society;* **46**: 183-184(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47100 **Additional enhancement of fusion energy production during neutral-beam injection.** Gilligan, J.; Stroud, P. (North Carolina State University, Raleigh, NC 27650). *Transactions of the American Nuclear Society;* **46**: 223-224(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47101 **Reactivity enhancement by fast waves in advanced fuel tokamaks.** Splitt, E.F.; Blue, T.E. (University of Illinois, Urbana, IL 61801). *Transactions of the American Nuclear Society;* **46**: 221-223(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47102 **Analytical solution of the distribution function and thermalized fraction of fusion reaction products in TMRs.** Zerguini, T.H. (University of Illinois, Urbana, IL 61801). *Transactions of the American Nuclear Society;* **46**: 224-225(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47103 **Design of a burn dynamic experiment.** Miley, G.H. *Transactions of the American Nuclear Society;* **46**: 220-221(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47104 **Results from the ohmic heating phase of TFTR experimental operations.** Grove, D.J. (Princeton University, Plasma Physics Laboratory, P.O. Box 451, Princeton, NJ 08544). *Transactions of the American Nuclear Society;* **46**: 182(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

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REFER ALSO TO CITATION(S) 70020046180, 46189, 46202, 46218, 46494, 47092, 47099

47105 **(AD-A—140688/3) Transmission system development for electron cyclotron heating experiments of a tokamak plasma. Final report 13 May 81-12 Jul 82.** Levine, J.S. (JAYCOR, Alexandria, VA (USA)). 2 Apr 1984. 48p. NTIS, PC A03/MF A01.

The heating of tokamak plasmas by microwaves at electron cyclotron frequency has been the subject of investigation for several years by several groups including the Naval Research Laboratory (NRL). To enable electron cyclotron heating (ECH) to produce significant temperature increases, the incident microwave power must be as strong as, or stronger than, the ohmic heating power required for the tokamak discharge. However, ECH experiments are limited to the current available microwave power. To address the issue of microwave power, NRL designed, built and tested a high power (approx. 300 kW) gyrotron for operation at a 1 microsec pulse length. In order to use this source for ECH experiments, a transmission system was designed and built that polarized the microwaves for optimal heating efficiency and coupled them into the tokamak plasma with minimal loss. The development of the transmission system is the topic of this Final Report. The report consists of two parts. First is a paper describing the subject of rippled wall mode converters for circular waveguides. The second part is a compilation of the engineering drawings developed for the construction of the antenna or transmission system.

47106 **(ANL/FPP/TM—188) Impurity Control Test Facility (ICTF) for the study of fusion reactor plasma/edge materials interactions.** Brooks, J.N.; Mattas, R.F.; Ehst, D.A.; Boley, C.D.; Hershkowitz, N. (Argonne National Lab., IL (USA)). May 1984. Contract W-31-109-ENG-38. 71p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84017443.

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A test facility for investigating many of the impurity control issues associated with the interactions of materials with the plasma edge is outlined. Analysis indicates that the plasma edge conditions expected in TFCX, INTOR, etc. can be readily produced at the end cells of an rf stabilized mirror, similar in some respects to the Phaedrus device at the University of Wisconsin. A steady-state, Impurity Control Test Facility (ICTF) based on such a mirror device is expected to produce a plasma with typical parameters of n/sub e/ $\sim 3 \times 10^{18}$ m^{-3}, T/sub e/ = 50 eV, and T/sub i/ = 100 eV at each end cell. A heat load of ~ 2 MW/m^2 over areas of ~ 1600 cm^2 could be produced at each end with 800 kW of ICRH power. These conditions would provide a unique capability for examining issues such as erosion/redeposition behavior, properties of redeposited materials, high recycling regimes, plasma edge operating limits for high-Z materials, and particle pumping efficiencies for limiter and divertor designs.

47107 **(ANL/FPP/TM—189) Thermal-hydraulic limitations on water-cooled limiters.** Cha, Y.S.; Misra, B. (Argonne National Lab., IL (USA)). Aug 1984. Contract W-31-109-ENG-38. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017428.

An assessment of the cooling requirements for fusion reactor components, such as the first wall and limiter/divertor, was carried out using pressurized water as the coolant. In order to establish the coolant operating conditions, a survey of the literature on departure from nucleate boiling, critical heat flux, asymmetrical heating and heat transfer augmentation techniques was carried out. The experimental data and the empirical correlations indicate that thermal protection for the fusion reactor components based on current design concepts can be provided with an adequate margin of safety without resorting to either high coolant velocities, excessive coolant pressures, or heat transfer augmentation techniques. If, however, the future designs require heat transfer enhancement techniques, experimental verification would be necessary since no data on heat transfer augmentation techniques exist for complex geometries, especially under asymmetrically heated conditions. Since the data presented herein concern primarily thermal protection, the final design should consider other factors such as thermal stresses, temperature limits, and fatigue.

47108 **(ANL/FPP/TM—190) Simulation of multiple stability regions in an internally cooled superconducting conductor with the computer code SSICC.** Turner, L.R.; Shindler, J. (Argonne National Lab., IL (USA); EG and G Idaho, Inc., Idaho Falls (USA)). Aug 1984. Contract AC07-76ID01570;W-31-109-ENG-38. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017500.

The computer code SSICC (Safety and Stability of Internally Cooled Conductors) has successfully simulated the multiple stability regions observed experimentally by Lue, Miller, and Dresner of Oak Ridge National Laboratory. The simulation requires asymmetrical boundary conditions and a heating pulse duration short compared to the time for reflection of the transient pressure wave back into the heated region of the conductor.

47109 **(BNL—51762) BNL Neutral Beam Development Group. Progress report, FY 1983 and final report.** Prelec, K.; Sluyters, T. (Brookhaven National Lab., Upton, NY (USA)). 16 Mar 1984. Contract AC02-76CH00016. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017601.

The BNL Neutral Beam Development Group has been active in the program for the development of high energy, high power neutral beam systems since 1973. These injectors are based on the production, acceleration and neutralization of negative hydrogen or deuterium ions and are supposed to be used for plasma heating and current drive in the next generation of fusion devices. Over the span of 10 years the group has studied plasma-surface type of negative hydrogen ion sources, transport and acceleration of negative ion beams and neutralization of negative ions in gases and plasmas. As the required source parameters (current, pulse length, efficiency) were changing over this period of time, the group developed several types of sources, resulting finally in the design of a steady state device operating with an excellent gas efficiency and having the possibility of scaling-up to the size necessary for a high power neutral beam system. The funding of this program was, however, terminated in FY 83 before the neutral beam performance of the source could be shown. This report will present a summary of the BNL effort over the past ten years, with most emphasis on achievements in FY 83, including the description of the 2 A steady state H^- or D^- ion source for use in a neutral beam line and of the plasma neutralizer capable to achieve neutralization efficiencies above 80%.

47110 (CONF-840370—, pp 1-6) **Calculation of island widths in three-dimensional equilibria.** Reiman, A.H.; Boozer, A.H. (Princeton Univ., NJ). May 1984. NTIS, PC A09/MF A01. File Number TI84012019. Contract AC02-76CH03073.

From US/Japan workshop on 3-D MHD studies; Oak Ridge, TN, USA (19 Mar 1984).

Stellarator vacuum fields are constructed to have relatively good flux surfaces. The islands that exist are small relative to the minor radius. With finite β, the flux surfaces are shifted and distorted. It has been expected that the flux surfaces break up at some critical β. The convention has been to take the equilibrium β limit to be that value of β at which the magnetic axis shift equals half the minor radius. There have previously been no actual calculations of this β limit. In the following, we first describe our general analysis of island formation in three-dimensional equilibria, summarizing the general conclusions, and then detailing some of the mathematics by which we arrive at the conclusions. We finally apply the analy-

sis to the particular example of the heliac device studied at Princeton.

47111 (CONF-840370—, pp 21-33) **Equilibrium studies of helical axis stellarators.** Hender, T.C.; Carreras, B.A.; Garcia, L.; Harris, J.H.; Rome, J.A.; Cantrell, J.L.; Lynch, V.E. (Oak Ridge National Lab., TN). May 1984. NTIS, PC A09/MF A01. File Number TI84012019.

From US/Japan workshop on 3-D MHD studies; Oak Ridge, TN, USA (19 Mar 1984).

The equilibrium properties of helical axis stellarators are studied with a 3-D equilibrium code and with an average method (2-D). The helical axis ATF is shown to have a toroidally dominated equilibrium shift and good equilibria up to at least 10% peak beta. Low aspect ratio heliacs, with relatively large toroidal shifts, are shown to have low equilibrium beta limits (~ 5%). Increasing the aspect ratio and number of field periods proportionally is found to improve the equilibrium beta limit. Alternatively, increasing the number of field periods at fixed aspect ratio which raises and lowers the toroidal shift improves the equilibrium beta limit.

47112 (CONF-840370—, pp 42-57) **Stellarator expansion studies of a high-beta torsatron.** Holmes, J.A.; Carreras, B.A.; Charlton, L.A.; Hicks, H.R.; Lynch, V.E. (Oak Ridge National Lab., TN). May 1984. NTIS, PC A09/MF A01. File Number TI84012019.

From US/Japan workshop on 3-D MHD studies; Oak Ridge, TN, USA (19 Mar 1984).

ATF is a medium aspect ratio (R/sub c//a/sub c/ = 7) l = 2 continuous torsatron with twelve field periods (M = 12). This configuration has been demonstrated, using the stellarator expansion, to have good MHD equilibrium and stability properties with increasing β. Present studies are directed toward improving the flexibility of the ATF design by determining means of controlling important plasma parameters, such as the magnetic well and the rotational transform profile. We concentrate here on the use of the ATF vertical-field (VF) coil system in providing this control.

47113 (CONF-840370—, pp 126-137) **Magnetic equilibria for square and circular EBTs.** Hedrick, C.L.; Owen, L.W. May 1984. NTIS, PC A09/MF A01. File Number TI84012019.

From US/Japan workshop on 3-D MHD studies; Oak Ridge, TN, USA (19 Mar 1984).

For closed magnetic field line devices, scalar pressure MHD implies that the pressure surfaces are the same as surfaces of constant line integral dl/B. This relation can also be developed from the drift kinetic equation. Here we contrast this result with that obtained from the bounce averaged drift kinetic equation. We consider a collisionality regime such that the collision frequency is much less than the bounce frequency but comparable (within an order of magnitude) to the poloidal precession frequency. Under these circumstances it is reasonable to assume that scattering causes the distribution function to be approximately isotropic and that J is not conserved on a drift time scale. This assumption allows us to make a direct comparison to the MHD results which would not be possible for lower collisionality where the distribution function would be anisotropic and approximately a function of ϵ, μ, and J. Our motivation for discussing this collisionality regime lies in its possible application to the EBT-I/S and NBT-IM experiments as well as to configurations projected for the near future such as the ELMO Bumpy Square.

47114 (CONF-840534—1) **Effects of monolayer coverages on substrate sputtering yields.** Gruen, D.M.; Krauss, A.R.; Pellin, M.J. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 28p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84016312.

From Workshop on synergistic effects in surface phenomena related to plasma-wall interactions; Nagoya, Japan (21 May 1984).

Materials currently being used or considered for plasma-side applications are not entirely satisfactory, particularly in the medium edge temperature (~ 100 to 300 eV) regime. A new approach to impurity control based on self-sustaining surface segregated low-Z layers with high secondary ion fractions has been suggested and tested in laboratory experiments. A crucial requirement is that substrate sputtering yields be reduced about an order of magnitude by monolayer adsorbate coverages. Theoretical and experimental evidence is adduced to support the contention that overlayer coverages (a monolayer of Li on Cu) result in profound reductions of substrate (e.g., Cu) sputtering yields. The conclusion that a material such as a dilute alloy of Li in Cu could function as a limiter or a divertor plate material is, in part, based on the fact that more than 85% of the sputtered flux originates in the first atomic layer (e.g., Li) of the target.

47115 (CONF-840804—38) **Cost assessment of a generic magnetic fusion reactor.** Sheffield, J.; Dory, R.A. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016597.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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A generic magnetic fusion reactor model is used to determine the conditions under which electricity generation from fusion would be economically viable. The use of a generic model helps to circumvent problems associated with present perceptions of magnetic configurations. It helps also to decouple those limitations set by generic constraints such as nuclear cross sections from those set by the state of development today. The model shows that only moderate advances are required in reactor characteristics over current designs to make an economically attractive magnetic fusion reactor.

47116 (CONF-840807—1) **Blanket materials for fusion reactors: comparisons of thermochemical performance.** Johnson, C.E.; Fischer, A.K.; Tetenbaum, M. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016240.

From Conference on thermodynamics; Hamilton, Canada (13 Aug 1984).

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Thermodynamic calculations have been made to predict the thermochemical performance of the fusion reactor breeder materials, Li_2O, $LiAlO_2$, and Li_4SiO_4 in the temperature range 900 to 1300°K and in the oxygen activity range 10^{-35} to 10^{-8}. Except for a portion of these ranges, the performance of $LiAlO_2$ is predicted to be better than that of Li_2O and Li_4SiO_4. The protium purge technique for enhancing tritium release is explored for the Li_2O system; it appears advantageous at higher temperatures but should be used cautiously at lower temperatures. Oxygen activity is an important variable in these systems and must be considered in executing and interpreting measurements on rates of tritium release, the form of released tritium, diffusion of tritiated species and their identities, retention of tritium in the condensed phase, and solubility of hydrogen isotope gases.

47117 (CONF-841201—14) **Heat transfer and mechanical interactions in fusion nuclear systems.** Nygren, R.E. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016233.

From ASME winter annual meeting; New Orleans, LA, USA (9 Dec 1984).

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This general review of design issues in heat transfer and mechanical interactions of the first wall, blanket and shield systems of tokamak and mirror fusion reactors begins with a brief introduction to fusion nuclear systems. The design issues are summarized in tables and the following examples are described to illustrate these concerns: the surface heating of limiters, heat transfer from solid breeders, MHD effects in liquid metal blankets, mechanical loads from electromagnetic transients and remote maintenance.

47118 (DOE/ER—0197) **Compact toroid development: activity plan for field reversed configurations.** (USDOE Office of Energy Research, Washington, DC. Office of Fusion Energy). Jun 1984. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017145.

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This document contains the description, goals, status, plans, and approach for the investigation of the properties of a magnetic configuration for plasma confinement identified as the field reversed configuration (FRC). This component of the magnetic fusion development program has been characterized by its potential for physical compactness and a flexible range of output power. The included material represents the second phase of FRC program planning. The first was completed in February 1983, and was reported in DOE/ER-0160; Compact Toroid Development. This planning builds on that previous report and concentrates on the detailed plans for the next several years of the current DOE sponsored program. It has been deliberately restricted to the experimental and theoretical efforts possible within the present scale of effort. A third phase of this planning exercise will examine the subsequent effort and resources needed to achieve near term (1987 to 1990) FRC technical objectives.

47119 **(DOE/ER—0199) Compact toroid development. Resource needs for field reversed configurations.** (USDOE Office of Energy Research, Washington, DC. Office of Fusion Energy). Aug 1984. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017390.

This document contains the goals and technical approach for the five years 1985 to 1990 for the investigation of the properties of a magnetic configuration for plasma confinement identified as the field reversed configuration (FRC). The included material represents the third phase of FRC program planning. The first was reported in DOE/ER-0160: Compact Toroid Development, Status and Technical Needs, February 1983. The second was reported in DOE/ER-0197: Compact Toroid Development, Activity Plans for Field Reversed Configurations, June 1984. This planning identifies the facilities and resources needed to achieve the goals set forth in the first two phases. The information in this document is based on technical recommendations provided by the FRC community.

47120 **(DOE/ER/13048—1) Investigation of electromagnetic launcher behavior for impact fusion. Annual report, July 1, 1983-May 1, 1984.** Thio, Y.C. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Jun 1984. Contract AC02-83ER13048. 113p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84017401.

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A program to develop an ultrahigh velocity accelerator (SUVAC), based on the electromagnetic railgun accelerator concept and sponsored by the US Department of Energy, has been initiated at Westinghouse R and D Center. The program involves the construction over a 4-year period (July 1983 to June 1987) of a multi-stage railgun accelerator which has the potential of accelerating a 1-g projectile to about 30 km/s (Mach 100). The scientific objective of the program is to use the accelerator so built as the experimental apparatus to investigate the potential technical problems of accelerating macroparticles to velocity presently thought to be required to produce impact fusion. The program is part of a joint program with the University of Washington to develop the scientific and technological basis to achieve controlled thermonuclear fusion by hypervelocity impact. This report summarizes the progress made in the first year of the program. It covers work done for the period July 1, 1983 to May 1, 1984.

47121 **(DOE/ET/51013—111) Versator divertor experiment: preliminary designs.** Wan, A.S.; Yang, T.F. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Aug 1984. Contract AC02-78ET51013. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017159.

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The emergence of magnetic divertors as an impurity control and ash removal mechanism for future tokamak reactors bring on the need for further experimental verification of the divertor merits and their ability to operate at reactor relevant conditions, such as with auxiliary heating. This paper presents preliminary designs of a bundle and a poloidal divertor for Versator II, which can operate in conjunction with the existing 150 kW of LHRF heating or LH current drive. The bundle divertor option also features a new divertor configuration which should improve the engineering and physics results of the DITE experiment. Further design optimization in both physics and engineering designs are currently under way.

47122 **(DOE/OR/00033—T74) Characterization of the effects of continuous salt processing on the performance of molten salt fusion breeder blankets.** Patterson-Hine, F.A. (Texas Univ., Austin (USA)). May 1984. Contract AC05-76OR00033. 117p. NTIS, PC A06/MF A01; GPO Dep. File Number DE84017138.

Thesis.

Several continuous salt processing options are available for use in molten salt fusion breeder blanket designs. The effects of processing on blanket performance have been assessed for three levels of processing and various equilibrium uranium concentrations in the salt. A one-dimensional model of the blanket was used in the neutronics analysis which incorporated transport calculations with time-dependent isotope generation and depletion calculations. The level of salt processing was found to have little effect on the behavior of the blanket during reactor operation; however, significant effects were observed during the decay period after reactor shutdown.

47123 **(HEDL-TME—84-13) FMIT test-end instrumentation conceptual design.** Fuller, J.L. (Hanford Engineering Development Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76FF02170. 199p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE84017202.

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FMIT test-end measurement techniques and instrumentation concepts for deuteron beam control, test-end device protection, test cell radiation field characterization, lithium jet performance monitoring, and in-situ off-line target testing and examination are described. The test-end refers to the beam line-target-test assembly interface area inside the test cell, but TEI includes measurements inside and outside the cell. The measurement requirements are briefly reviewed and referenced. The sometimes severe environmental limitations are discussed. Where feasible, multifunctional systems have been configured. Special facility features have been minimized.

47124 **(LA-UR—84-2555) Simulation of the interaction of single-pulsed optical lasers with targets in a vacuum.** Goldman, S.R.; Canavan, G.H.; Dingus, R.S.; Mahaffy, M.A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 7p. (CONF-840899—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016476.

From 5. international symposium on gas flow and chemical lasers; Oxford, UK (20 Aug 1984).

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We present computer simulations of the interaction of a perturbed laser beam on an aluminum target at pulse widths from .05 to 2.0 μsec, and intensities from 5 x 10^7 to 10^{13} W/cm^2, at laser wavelengths varying from 0.25 μm (KrF laser) to 10.6 μm (CO_2 laser). We focus on impulse coupling, identify the critical processes for momentum generation, and discuss the uncertainties in modeling.

47125 **(N—84-12909) Magnetohydrodynamic equilibrium and stability of spheromak plasma in flux conserver.** Kaneko, S.; Takimoto, A. (Nagoya Univ. (Japan)). Aug 1983. 33p. (IPPJ—642). NTIS, PC A03/MF A01.

The Green-function method is applied to the Grad-Shafranov equation for the plasma in a flux conserver with a rectangular cross section. The linear and the nonlinear MHD equilibrium configurations for various strengths of the toroidal magnetic field B are determined by this method. The average beta value B and the safety factor are also evaluated. When B is increased from zero, B decreases and vanishes at a force-free configuration. The safety factor takes a maximum value on the magnetic axis. A sufficient condition for stability to symmetric perturbations is derived by use of Edenstraser's condition. This sufficient condition holds for the flux conserver of any shape. As an example, the region, in which this sufficient condition is fulfilled, is shown graphically for the flux conserver with rectangular cross section.

47126 **(N—84-12910) Steady-state axisymmetric toroidal system.** Hirano, K. (Nagoya Univ. (Japan)). Aug 1983. 67p. (IPPJ—643). NTIS, PC A04/MF A01.

Conditions for achieving a steady state in an axisymmetric toroidal system were studied with emphasis on a very high beta field reversed configuration. Analysis made for the electromotive force produced by the Ohkawa current induced by a neutral beam injection shows that since the perpendicular component of the current to the magnetic field can be generated automatically by diamagnetic effect only the parallel component must be driven by the electromotive force. The drive of the parallel component generates the shear in the field line, so that the pure toroidal field on the magnetic axis is rotated towards the plasma boundary and is matched to the external field lines. This matching condition determines the necessary amount of injection beam current and power. It is demonstrated that a very high beta field reversed configuration requires only small amount of the current driving beam power because almost all the toroidal current except that close to the magnetic axis is carried by diamagnetic current due to high beta. A low beta tokamak needs very high current driving power since most of the toroidal current is composed of the parallel component which must be driven by the beam.

47127 **(N—8422781) Television system for monitoring target position in laser thermonuclear fusion experiments.** Vasin, B.L.; Valuyev, A.D.; Goryachuk, O.L.; Danilov, A.Y.; May, R.G.; Sklizkov, G.V.; Fedotov, S.I.; Chaushanskiy, S.A. (Joint Publications Research Service, Arlington, VA (USA)). Apr 1984. 2p. NTIS, PC A03/MF A01.

A four-channel TV system was developed for monitoring the positioning of working thermonuclear fusion targets in three dimensions with an error of + or - 5 micrometers. A target at a distance of from 250 to 350 mm is located in a spatial volume of 10 x 10 x 10 x 10 mm with a magnification of 17 it is set in three coordinates relative to a specified point in a volume of 1 x 1 x 1 mm with a magnification of 250. The configuration of the system using an He-Ne laser is diagrammed and discussed. The spherical targets have diameters of 50 to 800 micrometers. The spatial resolution in the target setting mode is 62 lines/mm. The ultimate magnification of the system is 500 photographs of TV images of polystyrene and glass targets are shown.

47128 **(ORNL/FEDC—84/2) Engineering analysis of TFTR disruption.** Murray, J.G.; Rothe, K.E.; Bronner, G. (Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017645.

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This report covers an engineering approach quantifying the currents, forces, and times, as well as plasma position, for the worst-case disruption based on engineerign circuit assumptions for the plasma. As the plasma moves toward the wall during the current-decay phase of disruption, the wall currents affect the rate of movement and, hence, the decay time. The calculated structure-induced currents differ considerably from those calculated using a presently available criterion, which specifies that the plasma remains stationary in the center of the torus while decaying in 10 ms. This report outlines the method and basis for the engineering calculation used to determine the current and forces as a function of the circuit characteristics. It provides specific calculations for the Tokamak Fusion Test Reactor (TFTR) with variations in parameters such as the thermal decay time, the torus resistance, and plasma temperature during the current decay. The study reviews possible ways to reduce the disruption damage of TFTR by reducing the magnitude of the plasma external field energy that is absorbed by the plasma during the current decay.

47129 **(ORNL/TM—9251) Multigroup energy-angle distributions for neutrons from the T(d,n)^{4}He reaction (E/sub d/ = 100 to 400 keV).** Santoro, R.T.; Barnes, J.M.; Drischler, J.D.; Alsmiller, R.G. Jr. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016636.

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The angle-energy dependence of neutrons produced in the T(d,n)^{4}He reaction from 100 to 400 keV deuterons incident on a 4 mg/cm^2-thick titanium tritide target has been calculated.

47130 **(PPPL—2123) PLT rotating pumped limiter.** Cohen, S.A.; Budny, R.V.; Corso, V.; Boychuck, J.; Grisham, L.; Heifetz, D.; Hosea, J.; Luyber, S.; Loprest, P.; Manos, D. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jul 1984. Contract AC02-76CH03073. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017070.

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A limiter with a specially contoured front face and the ability to rotate during tokamak discharges has been installed in a PLT pump duct. These features have been selected to handle the unique particle removal and heat load requirements of ICRF heating and lower-hybrid current-drive experiments. The limiter has been conditioned and commissioned in an ion-beam test stand by irradiation with 1 MW power, 200 ms duration beams of 40 keV hydrogen ions. Operation in PLT during ohmic discharges has proven the ability of the limiter to reduce localized heating caused by energetic electron bombardment and to remove about 2% of the ions lost to the PLT walls and limiters.

47131 **(PPPL—2126) Stellarator hybrids.** Furth, H.P.; Ludescher, C. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1984. Contract AC02-76CH03073. 20p. NTIS, PC A02/MF A0; 1; GPO Dep. File Number DE84017128.

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The present paper briefly reviews the subject of tokamak-stellarator and pinch-stellarator hybrids, and points to two interesting new possibilities: compact-torus-stellarators and mirror-stellarators.

47132 **(UCID—19946-Rev.1) S-11 and S-20 photocathode research activity. Rev. 1.** Gex, F.; Huen, T.; Kalibjian, R. (Lawrence Livermore National Lab., CA (USA)). 27 Aug 1984. Contract W-7405-ENG-48. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017164.

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The S-1 semi-transparent photocathode is the only one that can be used to study the 1.06 μm neodynium laser pulses of less than 10 ps duration. We first reviewed the recent results obtained at the Paris Observatory (research sponsored by the CEA), and then we tried to determine the role of the main constituents and their contributions in photoemission.

47133 **(UCID—30202) How to run HYBRID-II for mirror scenarios.** Mirin, A.A. (Lawrence Livermore National Lab., CA (USA)). Aug 1984. Contract W-7405-ENG-48. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017082.

HYBRID-II is a two-dimensional, multispecies, nonlinear Fokker-Planck code applicable to a square-well trap. The general ionic species are expressed in terms of distribution functions f/sub a/(x,θ). In addition several Maxwellian ion species may be specified. The electrons are approximately Maxwellian and are described by a density n/sub e/ and mean energy E/sub e/=3/2 T/sub e/; their collisional loss is given by a formula of Pastukhov. The core of HYBRID-II is the general Fokker-Planck package FPPAC. It is to be noted that HYBRID-II solves Fokker-Planck equations for the ions only. Problems which require the solution of a Fokker-Planck equation for the electron distribution function should be run with the code TDMFP.

47134 **(UCRL—90558) Progress in inertial confinement fusion at Lawrence Livermore National Laboratory.** Holzrichter, J.F. (Lawrence Livermore National Lab., CA (USA)). 6 Aug 1984. Contract W-7405-ENG-48. 10p. (CONF-840910—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016227.

From 10. international conference on plasma physics and controlled nuclear fusion research; London, UK (12 Sep 1984).

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The goals of the Inertial Fusion Program at the Lawrence Livermore National Laboratory are to study matter under extreme conditions of temperature and pressure and to produce fusion energy from inertially confined fusion fuel. With the conclusion of recent multi-kilojoule 0.53 μm experiments on Novette, we have demonstrated vastly improved plasma conditions compared to those previously obtained at LLNL with similar energies at 1.06 μm and elsewhere with 10 μm radiation. The lower preheat environment obtainable with short wavelength light has led to 3X improvements in the compression of targets on Novette compared to similar targets on Shiva with 1.06 μm. Subsequent experiments on Nova with short wavelength light will begin in 1985. They are expected to demonstrate the necessary compression conditions required for high gain fusion to occur when irradiated with a multi-megajoule driver. These recent results, together with improved calculations, and innovations in driver and reactor technology, indicate that high gain inertial fusion will occur and is a viable candidate for fusion power production in the future.

47135 **(UCRL—90619) Long-pulse beamlines for the mirror fusion test facility.** Stone, R.R.; Goldner, A.I.; Poulsen P. (Lawrence Livermore National Lab., CA (USA)). 5 Sep 1984. Contract W-7405-ENG-48. 7p. (CONF-840915—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017091.

From 13. symposium on fusion technology; Varese, Italy (24 Sep 1984).

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We have recently obtained test results indicating that a beam of pure full-energy deuterium particles can be delivered to the plasma targets in MFTF-B. We used a close-coupled separator magnet with the ion source to separate the impurities from the full-energy deuterium particles. Our completed studies show that the usual iron-core sweep magnet and shielding used in neutral beamlines can be eliminated and the gas flow out of the beamline decreased. This design also reduces beam losses. We will use smooth-bore OFHC tube arrays brazed to manifolds for the active heat transfer surfaces. Tests indicate that both burnout and life requirements are met by this design. In this paper, we present test results and discuss the MFTF-B long-pulse beamline configuration.

47136 **Energy confinement of high-density pellet-fueled plasmas in the Alcator C tokamak.** Greenwald, M.; Gwinn, D.; Milora, S.; Parker, J.; Parker, R.; Wolfe, S.; Besen, M.; Camacho, F.; Fairfax, S.; Fiore, C.; Foord, M.; Gandy, R.; Gomez, C.; Granetz, R.; LaBombard, B.; Lipschultz, B.; Lloyd, B.; Marmar, E.; McCool, S.; Pappas, D.; Petrasso, R.; Pribyl, P.; Rice, J.; Schuresko, D.; Takase, Y.; Terry, J.; Watterson, R. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review Letters;* **53**: No. 4, 352-355(23 Jul 1984). Contract AC02-78ET51013.

A series of pellet-fueling experiments has been carried out on the Alcator C tokamak. High-speed hydrogen pellets penetrate to within a few centimeters of the magnetic axis, raise the plasma density, and produce peaked density profiles. Energy confinement is observed to increase over similar discharges fueled only by gas puffing. In this manner record values of electron density, plasma pressure, and Lawson number (ntau) have been achieved.

47137 **A nuclear data measurement program for fusion energy development.** Haight, R.C. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, CA 94550). *Transactions of the American Nuclear Society;* **46**: 268-269(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47138 **Nuclear data libraries from Los Alamos for fusion neutronics calculations.** MacFarlane, R.E. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **46**: 271-272(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47139 **LLNL nuclear data libraries used for fusion calculations.** Howerton, R.J. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, CA 94550). *Transactions of the American Nuclear Society;* **46**: 270-271(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47140 **Status of charged-particle fusion cross sections.** Hale, G.M. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **46**: 269-270(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47141 **VITAMIN-E 174-neutron 38-gamma cross-section library for fusion neutronics calculations.** Roussin, R.W.; Bartley, J.L.; White, J.E. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **46**: 272-274(Jun 1984). (CONF-840614—).

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47142 **Fusion product energy loss effects on ICF target burns.** Harris, D.B.; Miley, G.H. (University of Illinois, Urbana, IL 61801). *Transactions of the American Nuclear Society;* **46**: 225-226(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47143 **Safety studies of the fission-suppressed fusion breeder.** Garner, J.K.; Maya, I. (TRW, One Space Park, Redondo Beach, CA 90278). *Transactions of the American Nuclear Society;* **46**: 211-212(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47144 **Fusion breeder economics, systems analysis and market penetration.** Berwald, D.H. (TRW, One Space Park, Redondo Beach, CA 90278). *Transactions of the American Nuclear Society;* **46**: 208-209(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47145 **Development pathways for the fusion breeder.** Amherd, N.A. (Titan Systems, Inc., 1742 Austin Ave., Los Altos, CA 94022). *Transactions of the American Nuclear Society;* **46**: 209-210(Jun 1984). (CONF-840614—).

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From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

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47149 **Critical issues for the fusion power demonstrator.** Doggett, J.N. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, CA 94550). *Transactions of the American Nuclear Society;* **46**: 179(Jun 1984). (CONF-840614—).

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47166 **Decision analysis methodology for the blanket comparison and selection study.** Piet, S.J.; Baker, C.C.; Waganer, L.M. (EG & G Idaho Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **46**: 197-198(Jun 1984). (CONF-840614—).

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47167 **Water-cooled liquid and solid breeder blanket concepts.** Morgan, G.D.; Bowers, D.; Gordon, J.D.; Hellwig, T.; Johnson, C.; Jung, J.; Liu, Y.Y.; Misra, B.; Sze, D.K.; Tuester, D. (McDonnell Douglas Astronautics Co., P.O. Box 516, St. Louis, MO 63166). *Transactions of the American Nuclear Society;* **46**: 198-199(Jun 1984). (CONF-840614—).

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47169 **A high-temperature low-activation design for the cascade reactor.** Pitts, J.H.; Creedon, R.L.; Walton, O.R. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, CA 94550). *Transactions of the American Nuclear Society;* **46**: 247-248(Jun 1984). (CONF-840614—).

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47200 **Inertial fusion commercial-applications driver cost issues and (some) answers.** Pendergrass, J.H. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **46**: 192-194(Jun 1984). (CONF-840614—).

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47201 **Blanket concept for neutron-feedback ICF reactors.** Kislev, H.; Miley, G.H. (University of Illinois, Urbana, IL 61801). *Transactions of the American Nuclear Society;* **46**: 191-192(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47202 **Heavy ion accelerators as drivers for inertial confinement fusion.** Warwick, A.I.; Herrmannsfeldt, W.B.; Keefe, D. (Lawrence Berkeley Laboratory, Univ. of California Berkeley, CA 94720). *Transactions of the American Nuclear Society;* **46**: 189-190(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47203 **An advanced light ion beam reactor driver.** Cook, D.L.; Buttram, M.T.; Olson, R.E. (Sandia Nat'l Laboratories, P.O. Box 5800, Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **46**: 188-189(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47204 **Excimer lasers for inertial confinement fusion.** Singer, S. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **46**: 187-188(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47205 **Solid-state laser driver technology for inertial confinement fusion.** Holzrichter, J.F. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, CA 94550). *Transactions of the American Nuclear Society;* **46**: 187(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47206 **A "FIRST STEP" toward ICF commercialization.** Saylor, W.W.; Dudziak, D.J.; Pendergrass, J.H. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **46**: 241-242(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47207 **Irradiation and testing of SPAULRAD-S for fusion magnet applications.** Schmunk, R.E.; Becker, H. (EG & G Idaho Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **46**: 262-263(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47208 **Low-activation diagnostic equipment and auxiliary heating components for fusion.** Hopkins, G.R. (GA Technologies, P.O. Box 81608, San Diego, CA 92138). *Transactions of the American Nuclear Society;* **46**: 260-262(Jun 1984). (CONF-840614—).

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

47209 **Design criteria for afterheat and decay heat removal in fusion and fusion-fission power plants.** Kastenberg, W.E. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). *Nuclear Engineering and Design/Fusion;* **1**: No. 1, 51-60(Jan 1984).

Afterheat and decay heat removal systems will be important safety features in fusion and fusion-fission hybrid power plants. Decay heat removal considerations for fission power reactors are reviewed and design criteria discussed. Aspects of fusion and fusion-fission afterheat and decay heat removal are also reviewed. It was found that afterheat thermal loads in fusion power reactors are a factor of 5 to 10 less than decay heat loads in fission power plants. However, they remain relatively constant over time periods of interest (out to a year in designs employing stainless steel), as compared to fission plants, whose decay heat loads drop an order of magnitude during the first day. Deterministic criteria for afterheat removal are presented. Although based upon fission reactor experience, they are modified to account for these differences. A probabilistic criterion was developed which is based on public health and economic considerations. A goal of 15×10^{-6} per reactor year was established for afterheat removal in fusion. For fusion-fission hybrid reactors, a goal ranging between 6×10^{-6} and 30×10^{-6} per reactor year was established. The upper limit corresponds to the recent NRC safety goal quideline for core melt frequency (1×10^{-4}/year), which has been suggested for the decay heat removal function in Pressurized Water Reactors. These goals are to be applied to a reliability analysis where major uncertainties can be quantified. 36 refs.

47210 **Thermal-hydraulic and thermo-structural analyses of the STARFIRE/DEMO tritium-breeding blanket.** Liu, Y.Y.; Majumdar, S.; Misra, B. (Argonne National Lab., IL (USA)); Burk, R.; Morgan, G.D. (McDonnell Douglas Astronautics Co., St. Louis, MO (USA)). *Nuclear Engineering and Design/Fusion;* **1**: No. 1, 73-95(Jan 1984).

Design features and thermal-hydraulic and thermo-structural aspects of the STARFIRE/DEMO tritium-breeding blankets are described and discussed. Design calculations which take into account thermal, mechanical, and materials performance, indicate favorable results for the viability of the blanket designs in general and point to key issues requiring further investigations.

47211 **Structural response of Tokamak TF magnet systems to in-plane and out-of-plane electromechanical loads.** Bobrov, E.S. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). *Nuclear Engineering and Design/Fusion;* **1**: No. 1, 39-50(Jan 1984).

A finite thickness, hybrid toroidal shell is presented to model the structural behavior of a Tokamak toroidal field magnet system, consisting of a discrete set of toroidal coils, with intercoil support structure. Both in-plane and out-of-plane electromechanical loads are considered. When the stiffness of the intercoil structure is accounted for, the membrane formulation of the model demonstrates strain incompatibility in the funicular 'D' coil configuration. Bending effects are predicted in this configuration; this is also demonstrated numerically. The model is applied in parametric structural analysis of several TF coil configurations with the aspect ratio of the 1981 FED design, under the action of in-plane and out-of-plane loads. An elliptical TF coil shape which exhibits significantly smaller bending stresses than the 'D' configuration is recommended as an alternative when, to meet plasma engineering requirements, an elongated coil shape is necessary.

47212 **Configurations, materials, and performance considerations for railguns in space propulsion.** Buckingham, A.C.; Hawke, R.S. (Univ. of California, Livermore). pp 385-401 of Orbit-raising and maneuvering propulsion: research status and needs. New York, NY; American Institute of Aeronautics and Astronautics (1984). Contract W-7405-ENG-48.

The railgun is essentially a dc Lorentz force mass accelerator. The Lorentz force is generated within an expanding current circuit, acting in association with a magnetic field which is enclosed by the current in the conductors. The current circuit is closed at one end by the power source and at the other by a moving armature. A dense plasma layer is used as the armature for practicality and reliability in repetitious acceleration of mass for thrust production. While the railgun is commonly associated with the acceleration and ejection of solid particles in direct launch applications, in the present discussion ejection and dispersion of vapor state mass for orbit-raising space propulsion applications are assumed. Fundamental information is sought on the interactive influences between power source, launcher configuration, materials, structural dynamics, electromagnetic field, and accelerated mass. Specific emphasis is placed on understanding the structure, dynamics, and material interaction influences of the dense plasma region. 11 references.

47213 **Plasmas in particle accelerators: a hydrodynamic model of three-dimensional electrostatic instabilities.** Krafft, G.A.; Mark, J.W.K.; Wang, T.S.F. (Lawrence Berkeley Lab., CA). *SIAM Journal on Applied Mathemadics;* **43**: No. 6, 1390-1399(Dec 1983).

In an earlier paper, closed hydrodynamic equations were derived with possible application to the simulation of beam plasmas relevant to designs of heavy ion accelerators for inertial confinement fusion energy applications. The closure equations involved a novel feature of anisotropic stresses even transverse to the beam. A related hydrodynamic model is used in this paper to examine further the boundaries of validity of such hydrodynamic approximations. It is also proposed as a useful tool to provide an economic means for searching the large parameter space relevant to three-dimensional stability problems involving coupling of longitudinal and transverse motions in the presence of wall impedance.

99 GENERAL AND MISCELLANEOUS

47214 **(LA—10130-PR) Isotope and Nuclear Chemistry Division annual report, FY 1983.** Heiken, J.H.; Lindberg, H.A. (eds.). (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 263p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE84017073.

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This report describes progress in the major research and development programs carried out in FY 1983 by the Isotope and Nuclear Chemistry Division. It covers radiochemical diagnostics of weapons tests; weapons radiochemical diagnostics research and development; other unclassified weapons research; stable and radioactive isotope production, separation, and applications (including biomedical applications); element and isotope transport and fixation; actinide and transition metal chemistry; structural chemistry, spectroscopy, and applications; nuclear structure and reactions; irradiation facilities; advanced analytical techniques; development and applications; atmospheric chemistry and transport; and earth and planetary processes.

47215 **(UCID—18574-84-1) Materials physics quarterly report, January-March 1984.** Moriarty, J.A. (ed.). (Lawrence Livermore National Lab., CA (USA)). 31 Aug 1984. Contract W-7405-ENG-48. 51p. NTIS, PC A04/MF A01; GPO Dep. File Number DE84017103.

Topics studied included: measurement of the temperature of the stationary arc in the H Division railgun; silica at ultrahigh temperature and expanded volume; variational fluid theory with inverse twelfth power reference potential; a model for L-shell transitions of N, O, and F-Like Ar ions; modeling neon-like selenium; theoretical instabilities in large deformation simple shear loading; and new theoretical EOS of PBX9404.

9901 Management

47216 **(DOE/IG—0208) Selected aspects of construction cost management.** (USDOE Office of Inspector General, Washington, DC). 7 Sep 1984. 27p. TIC. File Number TI84016925.

The purpose of the review was to determine the adequacy of procedures for the control over architect and engineer (A and E) costs, contingency and residual construction funds, and the quality of construction. Only selected aspects of construction were investigated; namely the adequacy of controls to ensure that (1) engineering, design, and inspection costs were reasonable; (2) contingency and excess construction funds were properly used, and (3) procedures for detecting substandard construction work were adequate. The review consisted of an examination of records, and interviews with responsible Department of Energy (DOE) officials. Field visits were made to the Albuquerque, Chicago, Oak Ridge, and San Francisco Operations Offices between February and June 1983, and Headquarters work was completed in the first part of 1984. The individual operations offices had improved the controls and procedures for identifying substandard construction work, and that such procedures were adequate. Further improvements are needed, however, in the areas of (1) managing and controlling contingency and residual construction funds, (2) controlling and accounting for architect and engineering costs, (3) selecting architect and engineering firms, and (4) accounting and reporting of cumulative construction costs. We also noted a need for DOE Headquarters to standardize, and more closely manage, the Department's construction program. There is a need to clarify the role of operating contractors in managing construction contracts in conformance with Departmental policy. This is our first audit report on the subject of construction.

47217 **(DOE/S—0031) Federal energy R and D priorities: materials research and development.** (USDOE Office of Energy Research, Washington, DC. Energy Research Advisory Board). Nov 1981. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84017284.

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Recommendations are presented on priorities within DOE's non-defense R and D program and suggests where funding should be changed, relative to the President's FY 1982 budget request. The ERAB has confined its recommendations to matters of science, technology and engineering. The salient findings of the Board are: (1) Funding relative to the President's FY 1982 budget request for the science and technology base programs should be increased in some programs and remain the same in others. Within these programs high priority should be given to: research on the phenomena governing accumulation of CO_2 in the atmosphere, and research into acid rain. (2) In the electric supply sector, priority should be given to supporting: nuclear waste isolation research and demonstration, conventional reactor systems and safety, the LMFBR base program, and uranium enrichment R and D. (3) Programs in which reductions can be made include: small reductions in magnetic fusion, significant reductions in the Clinch River breeder, the light water breeder, electricity transmission, and high temperature geothermal, and phase-out of funding for hydropower and magnetohydrodynamics. (4) The Board noted that the electric supply technology is receiving funding substantially in excess of its contribution to present and future energy supplies. (5) Technologies such as enhanced oil and gas recovery will be adequetely supported by the private sector. (6) R and D funding for energy conservation and end-use technology is underfunded. (7) The Board believes that if its recommendations are implemented, a net reduction in DOE's budget will result.

47218 **(GAO/AFMD—84-8) FERC can improve its operational performance by broadening and deepening current management efforts.** (General Accounting Office, Washington, DC (USA). Accounting and Financial Management Div.). 30 Jan 1984. 37p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901530.

The Federal Energy Regulatory Commission (FERC) issues thousands of similar documents each year, including licenses, rate change approvals, etc. Its operational performance can be evaluated by measuring the timeliness with which it issues these documents, the productivity of its staff (numbers of documents issued for a given staff level) and the quality of its work. FERC's timeliness has improved significantly in recent years. Its productivity has improved somewhat less. Quality, however, is unknown because FERC does not currently measure it. GAO believes that FERC's timeliness improvement has resulted from strong management attention, including specific improvement projects as well as techniques (such as measures of timeliness and goals for improvement) to assure that managers at all levels are accountable for timeliness. GAO recommends that FERC apply to productivity the techniques used to improve timeliness. It should also attempt to develop objective measures of quality. GAO also proposed fourteen more specific improvements. FERC management is currently taking action on these recommendations and proposals.

47219 **(GAO/RCED—83-118) Analysis of SEC's recommendation to repeal the Public Utility Holding Company Act.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 30 Aug 1983. 47p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901107.

The Securities and Exchange Commission (SEC) recommended to the Congress in December 1981 that the Public Utility Holding Company Act of 1935 be repealed. The act is intended to protect the public, investors, and consumers from abuses associated with the control of electric and gas utility companies through holding companies. SEC believes that the act has accomplished its basic purpose, duplicates other federal and state regulations, and is no longer needed to prevent recurrence of past abuses. GAO identified regulatory gaps that would occur if the act is repealed and found that some state regulatory officials believe they are unprepared to deal with the consequences of the act's repeal. GAO recommends that the Congress, in considering repealing or amending the act, address, through the appropriate congressional committees, the potential impacts that regulatory gaps at the federal level would have on state regulation and ultimately on consumers.

47220 **(GAO/RCED—84-128) Information on budget reductions in Energy Information Administration programs.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 4 May 1984. 9p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI84901518.

EIA budget reductions that occurred from fiscal year 1981 to fiscal year 1984 were reviewed and their effects on 6 EIA programs discussed. In that time period the budget was reduced by $35 million or 38% and the staff by 300 employees, or 42%. Of the six

programs, the Energy Emergency Management Information System has been replaced and the Middle Distillate Monitoring Program has been terminated. However, some of their functions continue to be carried out. Budget reductions were not a factor in the replacement and termination of these programs. In the four remaining programs (the Residential, Nonresidential Buildings, and Industrial Energy Consumption Surveys and the State Energy Data System) budget reductions have resulted in reduced data reliability and the elimination or suspension of two surveys that were primary sources of information for one program. Data reliability was reduced because survey sample sizes were reduced, survey universes were not updated, or surveys were conducted less frequently.

47221 **(LA-UR—84-2158) Technical manpower needs and resources at Los Alamos National Laboratory.** Freese, K.B. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 8p. (CONF-841055—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84015507.

From 16. national SAMPE technical conference on materials and processes; Albuquerque, NM, USA (9 Oct 1984).

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The Los Alamos National Laboratory has begun a program to share its scientific and technological expertise with students and teachers in the surrounding area. The goal of the Laboratory's Educational Outreach Program is to stimulate an awareness of professional opportunities in the sciences and engineering.

47222 **(LA-UR—84-2712) Federal laboratories: technology resources and transfer champions.** Stark, E.E. Jr. (Los Alamos National Lab., NM (USA)). Aug 1984. Contract W-7405-ENG-36. 23p. (CONF-840805—24). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016800.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

The Federal laboratories in the US employ a significant fraction of the nation's research and development resources, including technical staff, facilities and operating budgets. With a maturing base of national policy that encourages technical interchange with industry, universities and state and local governments, and with a breadth of technical areas under study, these laboratories represent a major national contingent asset - valuable yet not fully utilized. The laboratories have developed many methods of interaction with other organizations, providing a variety of ways to match needs and opportunities and to exploit any confluence of interests. The Federal Laboratory Consortium assists these laboratories in their transfer operations and helps to develop linkage opportunities. Many barriers to successful transfer are defined and surmountable.

47223 **(OTA-ISC—240) International cooperation and competition in civilian space activities. Summary.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Jul 1984. 35p. Congressional and Public Affairs, Office of Technology Assessment, US Congress, Washington, DC 20510. File Number TI84901739.

This summary presents the major findings of an assessment requested by the House Committee on Science and Technology and the Joint Economic Committee on international cooperation and competition in civilian space activities. The United States still enjoys strong competitive position in most space technologies and in space science. There continues to be broad support for a long-term public commitment to civilian space activities. The number of opportunities (and associated costs) that lie before us require a thoughtful articulation of space goals and objectives. Such goals should reflect a broad public consensus, including, but not limited to, those with obvious stake holdings in the space program. Defining these goals may be essential if the United States hopes to maintain its position of leadership at a reasonable cost. Maintaining a space program well-integrated with other national objectives will also require attention to the quantity and quality of cooperative international space projects. This report makes clear that the United States must cooperate in space in order to stay competitive.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 99020045890, 45891, 45955, 45970, 46344, 46436, 46437, 46558, 47070, 47133

47224 **(AD-A—141026/5) Parallel programming and the poker programming environment. Interim technical report.** Snyder, L. (Washington Univ., Seattle (USA). Dept. of Computer Science). Apr 1984. 26p. (TR—84-04-02). NTIS, PC A03/MF A01.

Parallel programming is described as the conversion of an abstract, machine independent algorithm to a form, called a program, suitable for execution on a particular computer. The conversion activity is simplified where the form of the abstraction is close to the form required of the programming system. Fine mechanisms are identified as commonly occurring in algorithms specification. The Poker Parallel Programming Environment is known to support these five mechanisms conveniently; thus the conversion is easy and the parallel programming is simple. The Poker environment is described and examples are provided. An analysis of the efficiency of the programming facilities provided by Poker is given and they all seem to be very efficient.

47225 **(AD-A—141131/3) Vectorized sparse elimination. Final report 1 May 80-30 Apr 84.** Calahan, D.A. (Michigan Univ., Ann Arbor (USA). Dept. of Electrical and Computer Engineering). 1 Mar 1984. 13p. NTIS, PC A02/MF A01.

This grant concerned the case of vector processors such as the CRAY-1 in the solution of sparse systems of equations. The study produced three major classifications of results: (1) Algorithms and related mathematical software for sparse solution on single processors (uniprocessors); (2) Preliminary projection of vector multiprocessor performance on linear algebra codes; and (3) Cooperative work on vector sparse matrix algorithms with AFFDL for CFD and structures codes, and with UC/Berkeley on for circuit simulation.

47226 **(ANL/MCS-TM—32) New directions in software for advanced computer architectures.** Dongarra, J.J.; Lusk, E.L.; Overbeek, R.A.; Smith, B.T.; Sorensen, D.C. (Argonne National Lab., IL (USA)). Aug 1984. Contract W-31-109-ENG-38. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017435.

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This report contains a collection of short position papers that were prepared for the Workshop on Taxonomy of Parallel Algorithms sponsored by Los Alamos National Laboratory and held at Santa Fe, New Mexico, November 30-December 2, 1983. These papers represent the authors views on directions of research that should be undertaken with regards to programming methodology, algorithm design, and software implementation for advanced computer architectures. Several projects have been initiated by the authors within the general framework outlined in these articles since they were written. The concepts formulated here are expected to serve as a foundation for future work in multiprocessing.

47227 **(CONF-840849—4) Empirical study on maximizing (or minimizing) the number of retentions in PPS sampling without replacement: two units per stratum.** Tsao, H.; Wright T. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016632.

From Annual meeting of the American Statistical Association (ASA); Philadelphia, PA, USA (12 Aug 1984).

Sampling strategies are determined to maximize (or minimize) the expected number of overlaps between two successive samples using the linear programming approach. The abilities to control overlaps between two successive samples are compared for five methods of sampling with two units selected, in terms of the maximum (or minimum) expected number of overlaps achieved. Six different types of artificial populations are considered to support the empirical study and to illustrate the differences among the five sampling procedures.

47228 **(DOE/OR/21400—T43) Basic Major Item System Mapping Project: Systems Integration Project.** Bengtson, P. (Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 28p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017377.

Oak Ridge National Laboratory (ORNL) has been working on six projects for the Army Materiel Command (AMC). Two of these six projects are presented in this booklet: Basic Major Item System Mapping (MISM) Project, and Systems Integration Project. A list of acronyms and an overview of ORNL capabilities are given at the end of this booklet.

47229 **(LA-UR—84-2609) Parallel processing of numerical transport algorithms.** Wienke, B.R.; Hiromoto, R.E. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 16p. (CONF-8408100—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84016825.

From Conference on vector and parallel processors in computational science II; Oxford, UK (28 Aug 1984).

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The multigroup, discrete ordinates representation for the linear transport equation enjoys widespread computational use and popularity. Serial solution schemes and numerical algorithms developed over the years provide a timely framework for parallel extension. On the Denelcor HEP, we investigate the parallel structure and extension of a number of standard S/sub n/ approaches. Concurrent inner sweeps, coupled acceleration techniques, synchronized inner-outer loops, and chaotic iteration are described, and results of computations are contrasted. The multigroup representation and serial iteration methods are also detailed. The basic iterative S/sub n/ method lends itself to parallel tasking, portably affording an effective medium for performing transport calculations on future architectures. This analysis represents a first attempt to extend serial S/sub n/ algorithms to parallel environments and provides good baseline estimates on ease of parallel implementation, relative algorithm efficiency, comparative speedup, and some future directions. We find basic inner-outer and chaotic iteration strategies both easily support comparably high degrees of parallelism. Both accommodate parallel rebalance and diffusion acceleration and appear as robust and viable parallel techniques for S/sub n/ production work.

47230 **(LA-UR—84-2683) User behavior upon introduction of a network help system.** Stoddard, M.L.; Berkbigler, K.P.; Wheat, R.M.; Peter, E.A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84016466.

An online help system, called ICNHELP, was implemented on the large Los Alamos Integrated Computing Network. Users from three different operating systems could quickly access summary information on network capabilities. Usage was monitored for a five-month period, and users were given the opportunity to comment online. There were three times as many accesses as users. Most users accessed ICNHELP to jog their memories about specific command information, but a high number used it as a browsing tool to learn about network capabilities. The study reveals that the user interface is important in user acceptance of an online user assistance tool, but the established patterns of user behavior and model of advertising also strongly affect the success of the system.

47231 **(PNL—5225) ISTUM PC: industrial sector technology use model for the IBM-PC.** Roop, J.M.; Kaplan, D.T. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76RL01830. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84017400.

A project to improve and enhance the Industrial Sector Technology Use Model (ISTUM) was originated in the summer of 1983. The project had dix identifiable objectives: update the data base; improve run-time efficiency; revise the reference base case; conduct case studies; provide technical and promotional seminars; and organize a service bureau. This interim report describes which of these objectives have been met and which tasks remain to be completed. The most dramatic achievement has been in the area of run-time efficiency. From a model that required a large proportion of the total resources of a mainframe computer and a great deal of effort to operate, the current version of the model (ISTUM-PC) runs on an IBM Personal Computer. The reorganization required for the model to run on a PC has additional advantages: the modular programs are somewhat easier to understand and the data base is more accessible and easier to use. A simple description of the logic of the model is given in this report. To generate the necessary funds for completion of the model, a multiclient project is proposed. This project will extend the industry coverage to all the industrial sectors, including the construction of process flow models for chemicals and petroleum refining. The project will also calibrate this model to historical data and construct a base case and alternative scenarios. The model will be delivered to clients and training provided. 2 references, 4 figures, 3 tables.

47232 **(SAND—84-8226) Users manual for BRGLM: interactive general linear model regression. Version 3.** Ringland, J.T.; Bohrer, R.E. (Sandia National Labs., Livermore, CA (USA)). Aug 1984. Contract AC04-76DP00789. 105p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84017386.

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BRGLM is an interactive computer program written in FORTRAN 77 to fit data to general linear regression models by least squares and to provide a wide variety of statistical diagnostic information about the fit. Less detailed all-subsets and stepwise regression routines are also included. In addition, there are several facilities for interactive data management (setting missing data flags, various transformations) and tools for constructing design matrices in the more common specialized models such as factorials, cubic splines, and autoregressions. This manual describes how to use BRGLM and, in its appendices, gives details of the computations carried out.

47233 **(UCID—20170) Documentation for an Instrument Database System.** Crawford, R.; Brand, H.; Wong, C.; Gregg, H.; Hoffman, P.; Enke, C. (Lawrence Livermore National Lab., CA (USA); Michigan State Univ., East Lansing (USA). Dept. of Chemistry). Sep 1984. Contract W-7405-ENG-48. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84017392.

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This document describes an Instrument Database System software package made up of a series of Fortran subroutines and programs. The database is particularly suited to multi-dimensional data such as that created by a triple quadrupole mass spectrometer. These subroutines and programs should compile and run on any DEC PDP-11 series computer using the RT-11 or RSX-11M operating system. The documentation of the software is broken down into six categories: (1) subroutines to store data in the database; (2) subroutines to read data from the database; (3) programs to print raw or averaged data from the database; (4) programs to extract selected parameters from the database in order to plot them; (5) plotting routines; and (6) utility routines to prepare dictionaries and to modify plot files. Additional documentation can be found within the listings of the programs, the subroutines, or the files having suffixes of .DOC, .TXT or .RNO.

47234 **(UCID—20171) Documentation for DIGLIB: Device Independent Graphics Library.** Brand, H.R. (Lawrence Livermore National Lab., CA (USA)). Sep 1984. Contract W-7405-ENG-48. 111p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84017385.

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DIGLIB (Device Independent Graphics LIBrary) is a collection of FORTRAN callable subroutines designed with the following goals: (1) easily usable by the casual graphics programmer for 2D plotting; (2) device independent (as much as possible); (3) small and reasonably fast; (4) device drivers are as simple as possible, and therefore easy to write, and device drivers may be written in FORTRAN when desired; (5) maintainable; (6) compatible with RT-11, RSX-11M, IAS, and VMS; and (7) compatible with MACRO, FORTRAN, F4P, FORTRAN-77, and OMSI PASCAL. DIGLIB comes very close to meeting all of the above design goals. Maintainability has been enhanced by using the INCLUDE feature of FORTRAN-IV-PLUS. Compatibility with RT-11 has been

maintained by writing a FORTRAN-IV-PLUS to FORTRAN-IV conversion program. Compatibility with OMSI PASCAL has been maintained by avoiding any FORTRAN I/O. Drivers are available for a variety of devices under RSX-11M, TSX, RT-11 and VMS. These include Tektronix 4000 series terminals, Retro-Graphics enhancements to several terminal types, HP 26xx terminals, and plotters.

47235 **(Y/CP—27) Role of DESIGNMANAGER in information engineering.** Futrell, T.L. (Oak Ridge Y-12 Plant, TN (USA)). 1984. Contract AC05-84OS21400. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84016807.

The American manufacturing industry is in trouble - we are constantly being bombarded with this message in the press. Is it any wonder. Our imbalance in world trade seems to set new records every month as our manufacturers struggle to compete with highly productive foreign companies. We have seen our overhead costs increase from 150 percent to 250 percent of direct labor costs in the 1950's to 550 percent to 850 percent today. This is largely because of the increased complexity of our manufacturing operations and the resulting tremendous increase in data proliferation. Increased manufacturing overheads are, to a significant degree, a measure of our failure to deal successfully with this data proliferation. While commercial enterprises have been successfully employing computer technology for years, the massive application of this technology to the management of data in the manufacturing environment lags far behind. Being a large manufacturing facility, the Oak Ridge Y-12 Plant has been faced with many of these problems. This paper will describe our efforts to apply currently available tools, such as DESIGNMANAGER, along with information engineering methods to the tremendous task of data management.

47236 **Bifurcation phenomena near homoclinic systems: A two-parameters analysis.** Gaspard, P.; Nicolis, G.; Kapral, R. (Faculte des Sciences, Universite Libre de Bruxelles, Campus Plaine, C.P. 231, 1050 Bruxelles, Belgium). *Journal of Statistical Physics;* **35**: No. 3, 697-748(Jun 1984). Contract AS05-81ER10947.

The bifurcations of periodic orbits in a class of autonomous three-variable, nonlinear-differential-equation systems possessing a homoclinic orbit associated with a saddle focus with eigenvalues (rho +- iω, λ), where 'rho/λ'<1 (Sil'nikov's condition), are studied in a two-parameters space. The perturbed homoclinic systems undergo a countable set of tangent bifurcation followed by period-doubling bifurcations leading to a periodic orbits which may be attractors if 'λ/l'<1/2. The accumulation rate of the critical parameter values at the homoclinic system is exp(-2π'rho/ω'). A global mechanism for the onset of homoclinicity in strongly contractive flows is analyzed. Cusp bifurcations with bistability and hysteresis phenomena exist locally near the onset of homoclinicity. A countable set of these cusp bifurcations with scaling properties related to the eigenvalues rho +- iω of the stationary state are shown to occur in infinitely contractive flows. In the two-parameter space, the periodic orbit attractor domain exhibits a spiral structure globally, around the set of homoclinic systems, in which all the different periodic orbits are continuously connected.

47237 **Computer-assisted analysis and model simplification.** Greenberg, H.J.; Maybee, J.S. (eds.). New York, NY; Academic Press, Inc. (1981). 517p. (CONF-8003202—). Academic Press, Inc., 111 Fifth Ave., New York, NY 10003. File Number TI84016833. Contract FG01-80EI10607.

From 1. symposium on computer-assisted analysis and model simplification; Boulder, CO, USA (28 Mar 1980).

The symposium covered structural modeling, qualitative stability analysis, qualitative determinancy and extension, embedded structures, and query systems. Abstracts of individual items from the symposium were prepared separately for the data base. (GHT)

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REFER ALSO TO CITATION(S) 99030046924

47238 **(BDX—613-3073) Integrating heterogeneous non-geometric information systems using rim.** Smith, M.L. (Bendix Corp., Kansas City, MO (USA)). Aug 1984. Contract AC04-76DP00613. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84017600.

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The Kansas City Division of the Bendix Corporation is addressing the task of achieving cost effective information flow and logical integration within a diverse set of manufacturing information systems. RIM is being tested as one component in a three-schema architecture for non-geometric data models. In this experiment, the enterprise or conceptual schema is captured and maintained in a vendor supported semantic information modeler. A RIM schema can be generated automatically from the information model. This allows transporting portions of the enterprise or conceptual schema to each information system. Results of tests on integration and data exchange performed to date will be reported.

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In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

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The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, VA 22161.

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AC04-76DP03533	Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant	
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AC04-78CS35359	Springborn Labs., Inc., Enfield, CT (USA)	
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AC04-82AL19929	Solar Energy Industries Association, Washington, DC (USA)	
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AC05-76OR00033	Oak Ridge Associated Universities, Inc., TN (USA)	
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AC05-78OR03054	Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.	
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	International Coal Refining Co., Allentown, PA (USA)	
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AC05-81OR20722	Bechtel National, Inc., Oak Ridge, TN (USA). Advanced Technology Div.	
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AC05-81OR20837	Science Applications, Inc., McLean, VA (USA)	
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AC05-84OR21400	Oak Ridge National Lab., TN (USA)	
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AC05-84OS21400	**Oak Ridge Y-12 Plant, TN (USA)**	
	9:47235	Y/CP—27
AC05-84OT21400	**Oak Ridge Gaseous Diffusion Plant, TN (USA)**	
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AC06-76FF02170	**Hanford Engineering Development Lab., Richland, WA (USA)**	
	9:47123	HEDL-TME—84-13
AC06-76RL01830	**Pacific Northwest Lab., Richland, WA (USA)**	
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AC07-76GJ01664	**Bendix Field Engineering Corp., Grand Junction, CO (USA). Grand Junction Operations**	
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AC08-76NV00410	**San Diego State Univ., CA (USA)**	
	9:46499	DOE/NV/00410—T3
AC08-81NV10162	**Nevada Univ., Reno (USA). Water Resources Center**	
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AC08-81NV10174	**Louisiana Geological Survey, Baton Rouge (USA)**	
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AC08-83NV10282	**EG and G, Inc., Goleta, CA (USA). Energy Measurements Group**	
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AC21-80MC14129	National Coal Board, Leatherhead (UK). Coal Utilization Research Lab.	
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AC21-82MC19210	General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.	
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AC21-83MC20037	Alaska Univ., Fairbanks (USA). Geophysical Inst.	
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AC21-83MC20700	Amax Extractive R and D, Inc., Golden, CO (USA)	
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AC22-78ET00269	Southwest Research Inst., San Antonio, TX (USA). Army Fuels and Lubricants Research Lab.	
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AC22-81PC40077	Union Carbide Corp., Tarrytown, NY (USA). Molecular Sieve Dept.	
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AC22-83PC60262	Rockwell International Corp., Canoga Park, CA (USA). Rocketdyne Div.	
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AC39-82RC11849	Resource Consulting Group, Inc., Cambridge, MA (USA)	
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AC79-79BP13222	Allen (Eliot) and Associates, Inc., Salem, OR (USA)	
	9:46103	DOE/BP—285
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AC79-82BP34623	Washington State Energy Office, Olympia (USA)	
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AC79-83BP13661	Ott Water Engineers, Inc., Bellevue, WA (USA)	
	9:46619	DOE/BP—245
AC96-83PO10850	Texas A and M Univ., College Station (USA)	
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AI01-76ET20320	Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Systems Technology Div.	
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AI01-76ET20356	Jet Propulsion Lab., Pasadena, CA (USA)	
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AI01-76PR06010	Thermophysics Division, National Bureau of Standards, Washington, DC 20234	
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AI01-80CS50194	Thermo Electron Corp., Waltham, MA (USA)	
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AI01-81FE00016	Bituminous Coal Research, Inc., Monroeville, PA (USA). National Lab.	
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AI79-83BP11980	Clearwater National Forest, Orofino, ID (USA)	
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AI79-83BP13483	Balance Associates, Seattle, WA (USA)	
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AS05-76EV14377	Duke Univ., Beaufort, NC (USA). Marine Lab.	
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AS05-80EV10363	Univ. of Tennessee, Knoxville	
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AS05-81ER10947	Faculte des Sciences, Universite Libre de Bruxelles, Campus Plaine, C.P. 231, 1050 Bruxelles, Belgiu	
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AS07-77ET28393	Utah Geological and Mineral Survey, Salt Lake City (USA)	
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AS08-82DP40171	Maryland Univ., College Park (USA). Lab. for Plasma and Fusion Energy Studies	
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AS09-76ER00854	Georgia Univ., Athens (USA). Dept. of Chemistry	
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AS19-80BC10310	New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center	
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AT02-80CH92122	Battelle Columbus Labs., OH (USA)	
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AT03-76ER70057	Stanford Univ., CA (USA). Dept. of Materials Science and Engineering	
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AT03-81ER10870	California Inst. of Tech., Pasadena (USA). W.M. Keck Lab. of Environmental Engineering Science	
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AT03-81ER40027	California Univ., Los Angeles (USA). Dept. of Physics	
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	California Univ., Los Angeles (USA)	
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AT03-83ER45008	Department of Physics, University of California, San Diego, La Jolla, California 92093	
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AT06-76EV71025	University of Washington, Seattle, Washington 98195	
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AT21-77MC08705	West Virginia Univ., Morgantown (USA). Coll. of Mineral and Energy Resources	
	9:45471	DOE/MC/08705—T1
AT21-77MC08710	West Virginia Univ., Morgantown (USA). Coll. of Engineering	
	9:45482	DOE/MC/08710—T1
AT21-77MC08712	West Virginia Univ., Morgantown (USA)	
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AT21-77MC08715	West Virginia Univ., Morgantown (USA)	
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AT21-77MC08718	West Virginia Univ., Morgantown (USA). Dept. of Chemical Engineering	
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AT21-78MC08722	West Virginia Univ., Morgantown (USA). Dept. of Electrical Engineering	
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AT21-78MC08723	West Virginia Univ., Morgantown (USA). Dept. of Physics	
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AT21-78MC08725	West Virginia Univ., Morgantown (USA)	
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AT21-79MC11448	West Virginia Univ., Morgantown (USA). Dept. of Chemistry	
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AT21-82MC19168	West Virginia Univ., Morgantown (USA). Dept. of Mechanical and Aerospace Engineering	
	9:45310	DOE/MC/19168—T1
FC01-83FE60149	National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)	
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FC02-80CS30333	Southwest Research Inst., San Antonio, TX (USA)	
	9:45747	DOE/CS/30333—T1
FC02-80CS30531	Mitchell (Robert) Solar Systems Design, Inc., Selkirk, NY (USA)	
	9:46118	DOE/CS/30531—T1
FC02-80RA50403	Caguas, Municipality of, Puerto Rico	
	9:46157	DOE/RA/50403—1
FC03-77SF10501	Southern California Edison Co., Rosemead (USA)	
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FC03-78ET20074	BioEnergy Development Corp., Hilo, HI (USA)	
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FC07-80ID12117	Acres American, Inc., Buffalo, NY	
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FC21-83FE60181	North Dakota Univ., Grand Forks (USA). Energy Research Center	
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FC79-83BP11189	BioSystems Analysis, Inc., Sausalito, CA (USA)	
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FG01-77ET10511	Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Civil Engineering	
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FG02-80CS69105	Minnesota Dept. of Energy and Economic Development, St. Paul (USA). Energy Div.	
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FG02-80R510230	Northwest Michigan Human Services Agency, Traverse City (USA)	
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FG02-81ER10916	Missouri Univ., Rolla (USA). Dept. of Chemical Engineering	
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FG02-84CE30804	Mid-Atlantic Solar Energy Association, Philadelphia, PA (USA)	
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FG03-81SF11611	California State Dept. of Transportation, Sacramento (USA). Div. of Aeronautics	
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FG03-84CE50036	Santa Clara Univ., CA (USA)	
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	Systems Applications, Inc., San Rafael, CA (USA)	
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FG05-80ET53088	Institute for Fusion Studies, University of Texas, Austin, Texas 78712	
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FG05-83OR21390	Council of Great Lakes Governors, Inc., Madison, WI (USA)	
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FG07-83ID12478	Oregon Inst. of Tech., Klamath Falls (USA). Geo-Heat Center	
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FG18-79ET14692	Minnesota Dept. of Natural Resources, St. Paul (USA). Div. of Minerals	
	9:45378	DOE/ET/14692—T7
FG22-82PC50796	California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering	
	9:46295	DOE/PC/50796—T6
FG22-83PC60778	SRI International, Menlo Park, CA (USA)	
	9:45322	DOE/PC/60778—3
FG22-83PC60785	Kentucky Univ., Lexington (USA)	
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FG22-83PC60807	Brigham Young Univ., Provo, UT (USA)	
	9:46264	DOE/PC/60807—4
FG45-81R510275	Ayres, Lewis, Norris and May, Inc., Ann Arbor, MI (USA)	
	9:45708	DOE/R5/10275—T1
FG48-81R807227	Millard Consultants, Salt Lake City, UT (USA)	
	9:46081	DOE/R8/07227—T1
FG48-81R808005	Scott (Richard W. and Beverly J.), Riverton, WY (USA)	
	9:45749	DOE/R8/08005—T1
FG48-81R808028	Wyoming Girl Scout Council, Casper (USA)	
	9:45750	DOE/R8/08028—T1
FG48-81R808031	Sun Valley Community Club, Inc., Cheyenne, WY (USA)	
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NAS-7-100-955567	Spectrolab, Inc., Sylmar, CA (USA)	
	9:45721	DOE/JPL/955567—84-15
NAS-7-100-956741	Research Triangle Inst., Research Triangle Park, NC (USA)	
	9:45722	DOE/JPL/956741—84/02
W-31-109-ENG-38	Argonne National Lab., IL (USA)	
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W-31-109-ENG-38	Argonne National Lab., IL (USA)	
	9:46680	ANL—84-30
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1	*See* INIS-mf-8889	DE84780612	MN -78	9:45996
CONF-820702-	(4. international symposium on finite element methods in flow problems, Tokyo, Japan, 26-29 Jul 1982)			
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CONF-820814-	(17. Intersociety Energy Conversion Engineering conference, Los Angeles, CA, USA, 8-13 Aug 1982)			
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CONF-820933-	(International conference on radioactive waste management, Winnipeg, Manitoba, Canada, 12-15 Sep 1982)			
Summs.	*See* INIS-mf-9040	DE84780568	MN -70	9:45531
CONF-820977-	(3. international conference on vibrations at surfaces, Pacific Grove, CA, USA, 1-4 Sep 1982)			
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CONF-8211171-	(7. inter-branch meeting on the sharing of experience in the management and improvement of electrostatic accelerators, Obninsk, USSR, 23-25 Nov 1982)			
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CONF-821258-	(Flat-plate solar array project research forum on quantifying degradation, Williamsburg, VA, USA, 6-8 Dec 1982)			
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CONF-830220-	(31. annual meeting of the Radiation Research Society - epidemiology of irradiated human populations, San Antonio, TX, USA, 27 Feb-3 Mar 1983)			
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CONF-830229-	(International daylighting conference, Phoenix, AZ, USA, 16-18 Feb 1983)			
3	*See* LBL-15623	DE84016896	MN -95d	9:45712
CONF-830425-	(Society of Photo-Optical Instrumentation Engineers conference, Santa Fe, NM, USA, 11-15 Apr 1983)			
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CONF-830455-	(Yamada conference on muon spin rotation and associated problems, Shimoda, Japan, 18-27 Apr 1983)			
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CONF-8304191-	(International school of nuclear physics, Erice, Italy, 6-18 Apr 1983)			
1-App.6	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84016624	MN -34D	9:46934
CONF-830570-	(6. international conference on ion beam analysis, Temple, AZ, USA, 22-27 May 1983)			
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CONF-830586-	(13. international nuclear data committee meeting, Rio de Janeiro, Brazil, 16-20 May 1983)			
Summ.	*See* INDC-39/U	DE84702880	MN -34C	9:46929
CONF-8305126-	(Franco-Californian symposium on the management of energy in residential and commercial sectors, Sophia Antipolis, France, 16-19 May 1983)			
2	*See* LBL-16086	DE84016059	MN -95d	9:46123
CONF-8305161-	(Conference on materials and new processing technologies for photovoltaics, San Francisco, CA, USA, 9-13 May 1983)			
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CONF-8305212-	(EPRI seminar on annual review of demand and conservation research, Arlington, VA, USA, 17-20 May 1983)			
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CONF-830629-	(18. AIAA thermophysics conference, Montreal, Canada, 1-3 Jun 1983)			
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CONF-830631-	(6. biennial wind energy conference, Minneapolis, MN, USA, 1-3 Jun 1983)			
15	*See* N-84-13670			9:45909
CONF-830640-	(ASHRAE conference, Washington, DC, USA, 26-30 Jun 1983)			
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CONF-8306213-	(6. research coordination meeting on the measurement and evaluation of transactinium isotope nuclear data, Idaho Falls, ID, USA, 21-24 Jun 1983)			
Summ.	*See* INDC(NDS)-147/GE	DE84702891	MN -34C	9:47009

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1	*See* SSI-A-83-12	DE84702899	MN -4	9:46273
CONF-8306215-	(International conference on pipeline inspection, Edmonton, Alberta, Canada, 13-16 Jun 1983)			
1	*See* AECL-7981	DE84702979	MN -25	9:46516
CONF-8306237-	(Symposium on electroslag component casting, Morgantown, WV, USA, 1-2 Jun 1983)			
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CONF-8307130-	(EPRI seminar on annual review of demand and conservation research, Denver, CO, USA, 12-15 Jul 1983)			
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CONF-830814-	(186. national meeting of the American Chemical Society, Washington, DC, USA, 28 Aug-2 Sep 1983)			
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CONF-830847-	(Energy resource management '83, San Francisco, CA, USA, 23-27 Aug 1983)			
8	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016571	MN -4	9:45701
CONF-830862-	(10. international conference on few-body problems in physics, Karlsruhe, F.R. Germany, 21-27 Aug 1983)			
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CONF-8308191-	(American Society of Agricultural Engineers North Atlantic Region conference, Newark, DE, USA, 7-10 Aug 1983)			
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CONF-8308192-	(8. international seminar on ion-atom collisions, Utrecht, Netherlands, 4-5 Aug 1983)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016560	MN -34A	9:46846
CONF-8308195-	(11. international conference on photochemistry, College Park, MD, USA, 21-26 Aug 1983)			
1	*See* DOE/EV/03018-252	DE84017135	MN -4	9:46318
CONF-830960-	(Industrial wood energy forum '83, Nashville, TN, USA, 19-21 Sep 1983)			
2	*See* SERI/TP-215-2220	DE84013030	STD -61A	9:45707
CONF-830971-	(8. international conference on magnet technology and exhibition, Grenoble, France, 5-9 Sep 1983)			
10	*See* JINR-E-9-83-608	DE84702953	MN -28	9:46463
CONF-8310223-	(Society of Automotive Engineers meeting, San Francisco, CA, USA, 31 Oct-1 Nov 1983)			
	SAE Prepr., SAE-831697: 12(Oct 1983)			9:46164
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CONF-8310224-	(MPA seminar on safety of light water reactor pressure vessels, Stuttgart, F.R. Germany, 13-14 Oct 1983)			
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CONF-8310301-	(American Association of Petroleum Geologists eastern section meeting, Carbondale, IL, USA, 3-4 Oct 1983)			
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CONF-8310302-	(MIT industrial liaison program symposium on using coal benignly, Cambridge, MA, USA, 23 Oct 1983)			
3	Massachusetts Inst. of Technology, Cambridge, MA 02139	TI84901572	ND -90i	9:46607
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CONF-831137-	(International seminar on energy saving in buildings, Hague, Netherlands, 14-16 Nov 1983)			
1	*See* CEA-CONF-7181	DE84751843	MN -94e	9:46036
CONF-831151-	(State-of-the-art and emerging technologies: a waste-to-energy workshop, Chicago, IL, USA, 28-30 Nov 1983)			
	See ANL/CNSV-TM-137	DE84015454	MN -95e	9:46156
CONF-8311132-	(3. international seminar on the results of EC geothermal research, Munich, F.R. Germany, 29 Nov-1 Dec 1983)			
	See EUR-8853-EN			9:45781
CONF-8311174-	(7. national conference of the South African section of the Plastics and Rubber Institute, Johannesburg, South Africa, 10-11 Nov 1983)			
1	*See* INIS-mf-9034	DE84780606	MN -23	9:45672
CONF-8311196-	(3. illumination roundtabel workshop on lighting research and education for the eighties, Keystone, CO, USA, 13-16 Nov 1983)			
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CONF-831205-	(6. Miami international conference on alternative energy sources, Miami Beach, FL, USA, 12-14 Dec 1983)			
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CONF-840370-	(US/Japan workshop on 3-D MHD studies, Oak Ridge, TN, USA, 19-23 Mar 1984)			
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CONF-8403137-	(Workshop on detectors for relativistic nuclear collisions, Berkeley, CA, USA, 26-30 Mar 1984)			
1	*See* BNL-35107	DE84016992	MN -34D	9:46882

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CONF-840441-	(DOE annual photovoltaic program review, Kissimmee, FL, USA, 30 Apr 1984)			
Summs.	*See* SERI/CP-211-2109	DE84013003	MN -63	9:45731
CONF-840461-	(20. annual meeting of the National Council on Radiation Protection and Measurements, Washington, DC, USA, 4-5 Apr 1984)			
2	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84016243	MN -41	9:47041
CONF-840470-	(Nonpetroleum vehicular fuels IV symposium, Arlington, VA, USA, 16-18 Apr 1984)			
1	NTIS, PC A03/MF A01; 1	DE84901824	MN -96	9:46171
CONF-8404185-	(Japanese Society of Plant Physiologists meeting, Kanazawa, Japan, 2-6 Apr 1984)			
1	*See* LBL-18005	DE84015742	MN -48	9:46638
CONF-840534-	(Workshop on synergistic effects in surface phenomena related to plasma-wall interactions, Nagoya, Japan, 21-22 May 1984)			
1	NTIS, PC A03/MF A01 (GPO Dep.)	DE84016312	MN -20a	9:47114
CONF-840543-	(International symposium on alcohol fuels technology, Ottawa, Ontario, Canada, 21-25 May 1984)			
2	*See* SERI/TP-234-2245	DE84004507	STD -96	9:46174
CONF-840559-	(Commercial applications of solar conference and exhibit, Philadelphia, PA, USA, 30-31 May 1984)			
Summ.	*See* DOE/CE/30804-T1	DE84015914	MN -59	9:45746
CONF-840572-	(International symposium on observation of the continental crust through drilling, Tarrytown, NY, USA, 20-25 May 1984)			
4	*See* LA-UR-84-2564	DE84016475	MN -66b	9:45858
CONF-8405193-	(Conference on the intersections between particle and nuclear physics, Steamboat Springs, CO, USA, 23-30 May 1984)			
40	*See* BNL-35105	DE84016994	MN -34D	9:47012
CONF-8405223-	(Cold Spring Harbor symposium on quantitative biology in collaboration with NIH, Cold Spring Harbor, NY, USA, 30 May-5 Jun 1984)			
1	*See* BNL-35002	DE84015288	MN -48	9:46624
CONF-8405229-	(3. IAEA advisory group meeting on transactinium isotope nuclear data, Uppsala, Sweden, 21-25 May 1984)			
1	*See* EGG-M-12384	DE84014636	MN -34C	9:47005
CONF-8405231-	(International workshop on interacting boson-boson and boson-fermion systems, Gull Lake, MI, USA, 28-30 May 1984)			
1	*See* BNL-35168	DE84016997	MN -34C	9:47013
CONF-8405232-	(4. Leiden conference on mononuclear phagocytes, Noordwijk, Netherlands, 9-16 May 1984)			
1	*See* LA-UR-84-2663	DE84016464	MN -48	9:46630
CONF-840614-	(Annual meeting of the American Nuclear Society, New Orleans, LA, USA, 3-8 Jun 1984)			
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	Trans. Am. Nucl. Soc., 46: 278-279(Jun 1984)			9:47157
	Trans. Am. Nucl. Soc., 46: 275-277(Jun 1984)			9:47158
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	Trans. Am. Nucl. Soc., 46: 205-206(Jun 1984)			9:47161
	Trans. Am. Nucl. Soc., 46: 203-205(Jun 1984)			9:47162
	Trans. Am. Nucl. Soc., 46: 201-203(Jun 1984)			9:47163
	Trans. Am. Nucl. Soc., 46: 203(Jun 1984)			9:47164
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	Trans. Am. Nucl. Soc., 46: 195-197(Jun 1984)			9:47168
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	Trans. Am. Nucl. Soc., 46: 245-247(Jun 1984)			9:47170
	Trans. Am. Nucl. Soc., 46: 244-245(Jun 1984)			9:47171
	Trans. Am. Nucl. Soc., 46: 242-244(Jun 1984)			9:47172
	Trans. Am. Nucl. Soc., 46: 239-240(Jun 1984)			9:47173
	Trans. Am. Nucl. Soc., 46: 237-239(Jun 1984)			9:47174
	Trans. Am. Nucl. Soc., 46: 235-237(Jun 1984)			9:47175
	Trans. Am. Nucl. Soc., 46: 234-235(Jun 1984)			9:47176
	Trans. Am. Nucl. Soc., 46: 232-233(Jun 1984)			9:47177
	Trans. Am. Nucl. Soc., 46: 231-232(Jun 1984)			9:47178
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	Trans. Am. Nucl. Soc., 46: 248-249(Jun 1984)			9:47182
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	Trans. Am. Nucl. Soc., 46: 259-260(Jun 1984)			9:47190
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104	*See* EGG-M-00884	DE84016347	MN -78	9:45991
CONF-840627-	(29. annual meeting of the Health Physics Society, New Orleans, LA, USA, 3-7 Jun 1984)			
10	*See* UCRL-90178	DE84017033	MN -41	9:46559
CONF-8406133-	(DARPA propagation meeting, Monterey, CA, USA, 18-22 Jun 1984)			
14	*See* UCRL-90910	DE84017111	MN -28	9:46469
15	*See* UCRL-90912	DE84017112	MN -28	9:46471
16	*See* UCRL-90911	DE84017100	MN -28	9:46470
CONF-8406139-	(9. international CODATA conference, Jerusalem, Israel, 24-28 Jun 1984)			
1-Rev.1	*See* UCRL-90276-Rev.1	DE84016511	MN -25	9:46176
CONF-8406146-	(2. international conference on mass spectrometry and gas chromatography in biomedical sciences, Milan, Italy, 18-20 Jun 1984)			
2	*See* LA-UR-84-2499	DE84016481	MN -48	9:46661
CONF-8406155-	(19. AIAA thermophysics conference, Snowmass, CO, USA, 24-28 Jun 1984)			
3	*See* FNAL-TM-1277	DE84015639	MN -28	9:46460
CONF-8406166-	(Methanol symposium, El Monte, CA, USA, 29 Jun 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012950	MN -96	9:46565
CONF-8406167-	(25. plenary session of COSPAR, Graz, Austria, 25 Jun-7 Jul 1984)			
2	*See* LA-UR-84-2611	DE84016826	MN -34B	9:46840
3	*See* LA-UR-84-1992	DE84014029	MN -34B	9:46839
4	*See* LA-UR-84-2517	DE84016479	MN -34B	9:46796
CONF-8406183-	(15. international symposium on multiparticle dynamics, Lund, Sweden, 11-16 Jun 1984)			
2	*See* LA-UR-84-2505	DE84016480	MN -34D	9:46900
CONF-8406194-	(NATO advanced study institute on nonequilibrium quantum statistical mechanics, Santa Fe, NM, USA, 1 Jun 1984)			
1	*See* LA-UR-84-2751	DE84016779	MN -38	9:47047
CONF-840701-	(Topical meeting on fission product behavior and source term research, Snowbird, UT, USA, 15-19 Jul 1984)			
22	*See* EGG-TIO-M-0284	DE84016216	MN -78	9:45993
23	*See* EGG-M-10584	DE84016218	MN -78	9:45992
24	*See* EGG-TIO-M-0384	DE84016217	MN -78	9:45994
CONF-840725-	(3. international conference on infrared physics, Zurich, Switzerland, 23-27 Jul 1984)			
7	*See* LBL-17032	DE84016903	MN -25	9:46527
CONF-840734-	(25. annual meeting of the Institute of Nuclear Materials Management, Columbus, OH, USA, 15-18 Jul 1984)			
17	*See* LA-UR-84-2262	DE84015426	MN -15	9:45666

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CONF-840738-	(Progress in quantitative NDE, San Diego, CA, USA, 8-13 Jul 1984)			
1	*See* LBL-18051	DE84016908	MN -25	9:46198
2	*See* LA-UR-84-2741	DE84016773	MN -34	9:46430
3	*See* UCRL-90649	DE84017050	MN -37	9:46533
CONF-840757-	(22. international conference on high energy physics, Leipzig, German D.R., 19-25 Jul 1984)			
7	*See* LA-UR-84-2481	DE84016483	MN -34D	9:46943
CONF-840760-	(Ion beam modification of materials conference, Ithaca, NY, USA, 16-20 Jul 1984)			
11	*See* SAND-84-1708C	DE84016781	MN -34A	9:46203
CONF-840764-	(3. international EXAFS conference, Stanford, CA, USA, 16-20 Jul 1984)			
5	*See* LBL-18161	DE84016881	MN -34A	9:46850
CONF-840784-	(Nucleon and nuclear structure and exclusive electromagnetic reaction studies workshop, Cambridge, MA, USA, 23-24 Jul 1984)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016318	MN -34C	9:47014
CONF-840786-	(9. international conference on atomic physics, Seattle, WA, USA, 23-27 Jul 1984)			
2	*See* SLAC-PUB-3401	DE84016924	MN -34A	9:46855
CONF-840787-	(International summer school on crystallographic computing, Mulheim an der Ruhr, F.R. Germany, 30 Jul-8 Aug 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016631	MN -4	9:46175
CONF-840789-	(International conference on particles and nuclei, Heidelberg, F.R. Germany, 30 Jul-3 Aug 1984)			
1	*See* DOE/ER/02853-23	DE84016803	MN -34C	9:46951
2	*See* LA-UR-84-2480	DE84016484	MN -34D	9:46942
CONF-840790-	(2. workshop on rf superconductivity, Geneva, Switzerland, 23-27 Jul 1984)			
1	*See* SLAC-PUB-3412	DE84017193	MN -28	9:46468
CONF-840791-	(Workshop on physics of energy transport in extragalactic radio sources, Green Bank, WV, USA, 30 Jul-3 Aug 1984)			
1	*See* SAND-84-1780C	DE84016179	MN -34A	9:46835
CONF-840802-	(International topical meeting on fuel reprocessing and waste management, Jackson Hole, WY, USA, 26-29 Aug 1984)			
15	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016712	MN -86	9:45502
16	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016711	MN -86	9:45503
17	*See* EGG-M-25883	DE84017065	MN -86	9:45504
CONF-840803-	(3. international conference on indoor air quality and climate, Stockholm, Sweden, 20-24 Aug 1984)			
8	*See* LBL-17598	DE84016001	MN -11	9:46582
12	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016672	MN -41	9:46564
16	*See* LBL-17603	DE84016888	MN -11	9:46569
CONF-840804-	(Intersociety energy conversion engineering conference, San Francisco, CA, USA, 19-24 Aug 1984)			
30	*See* SERI/TP-252-2359	DE84004589	STD -62	9:45780
38	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016597	MN -20	9:47115
41	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016704	MN -94a	9:46037
43	*See* SERI/TP-231-2326	DE84004505	STD -61A	9:45704
44	*See* EGG-M-24183	DE84017018	MN -93	9:46113
45	*See* EGG-M-24383	DE84016995	MN -38	9:46143
46	*See* EGG-M-24483	DE84017016	MN -38	9:46144
47	*See* EGG-M-24283	DE84017017	MN -38	9:46121
CONF-840805-	(188. meeting of the American Chemical Society, Philadelphia, PA, USA, 26-31 Aug 1984)			
24	*See* LA-UR-84-2712	DE84016800	MN -13	9:47222
CONF-840806-	(18. DOE nuclear airborne waste management and air cleaning conference, Baltimore, MD, USA, 13-16 Aug 1984)			
8	*See* LA-UR-84-2479	DE84016485	MN -80	9:45661
10	*See* LA-UR-84-2531	DE84016478	MN -38	9:46449
CONF-840807-	(Conference on thermodynamics, Hamilton, Canada, 13-17 Aug 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016240	MN -20d	9:47116
CONF-840809-	(Geothermal Resources Council annual meeting, Reno, NV, USA, 27-29 Aug 1984)			
18	*See* EGG-M-10184	DE84017008	MN -66a	9:45884
19	*See* EGG-M-10284	DE84017009	MN -66g	9:45897
20	*See* EGG-M-09884	DE84017015	MN -66a	9:45883
CONF-840813-	(Design, construction and operation of nuclear power plants conference, Portland, OR, USA, 5-8 Aug 1984)			
13	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016696	MN -98	9:46079
CONF-840816-	(22. national heat transfer conference, Niagara Falls, NY, USA, 5-8 Aug 1984)			
20	*See* EGG-M-06984	DE84017237	MN -20d	9:46189
CONF-840819-	(Doing better: setting an agenda for the second decade, Santa Cruz, CA, USA, 14-22 Aug 1984)			
8	*See* LBL-17590	DE84016878	MN -95d	9:46124
9	*See* LBL-17889	DE84016885	MN -95d	9:46125
CONF-840821-	(1. international conference on the structure of surfaces (ICSOS), Berkeley, CA, USA, 13-16 Aug 1984)			
1	*See* LBL-18209	DE84016886	MN -25	9:46200
2	*See* LBL-18236	DE84016904	MN -25	9:46201
3	*See* LA-UR-84-2728	DE84016774	MN -25	9:46296

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CONF-840829-	(International conference on x-ray and inner-shell processes in atoms, molecules and solids, Leipzig, Germany D.R., 20-24 Aug 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016596	MN -34A	9:46845
CONF-840842-	(17. international conference on low temperature physics, Karlsruhe, F.R. Germany, 15-22 Aug 1984)			
29	*See* MLM-3140(OP)	DE84016940	MN -34	9:46348
CONF-840848-	(42. annual Electron Microscopy Society of America meeting, Detroit, MI, USA, 13-17 Aug 1984)			
6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016570	MN -20c	9:46180
8	NTIS, PC A02; 3 (GPO Dep.)	DE84016709	MN -25	9:46260
9	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016545	MN -25	9:45942
CONF-840849-	(Annual meeting of the American Statistical Association (ASA), Philadelphia, PA, USA, 12-16 Aug 1984)			
4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016632	MN -32	9:47227
CONF-840859-	(5. symposium on the transfer and utilization of particulate control technology, Kansas City, MO, USA, 27-30 Aug 1984)			
1	*See* DOE/FE-60181-73	DE84016952	MN -90	9:45926
CONF-840867-	(9. international protechnics seminar, Colorado Springs, CO, USA, 6-10 Aug 1984)			
4	*See* MLM-3183(OP)	DE84016942	MN -45	9:46233
6	*See* MLM-3184(OP)	DE84016946	MN -45	9:46545
7	*See* MLM-3185(OP)	DE84016945	MN -45	9:46546
8	*See* MLM-3181(OP)	DE84016941	MN -45	9:46544
9	*See* MLM-3186(OP)	DE84016944	MN -45	9:46547
CONF-840872-	(SPIE annual technical symposium, San Diego, CA, USA, 19-24 Aug 1984)			
11	*See* LA-UR-84-2422	DE84015536	MN -59a	9:45776
14-Rev.	*See* LA-UR-84-2336-Rev.	DE84016488	MN -32	9:47051
18	*See* LA-UR-84-2594	DE84016818	MN -37	9:46510
19	*See* LA-UR-84-2593	DE84016816	MN -38	9:46429
20	*See* LA-UR-84-2470	DE84016487	MN -37	9:46515
21	*See* LA-UR-84-2492	DE84016482	MN -25	9:46231
23	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016630	MN -34	9:46347
24	*See* SERI/TP-255-2387	DE84013027	STD -62a	9:45777
26	*See* UCRL-90540	DE84017045	MN -37	9:46532
CONF-840876-	(International conference on valence fluctuations, Koln, F.R. Germany, 27-30 Aug 1984)			
2	*See* LA-UR-84-2658	DE84016463	MN -25	9:47044
CONF-840878-	(Defects in semiconductors conference, Coronado, CA, USA, 13 Aug 1984)			
2	*See* SAND-84-0823C	DE84016727	MN -25	9:46246
CONF-840879-	(17. international conference on the physics of semiconductors, San Francisco, CA, USA, 6-10 Aug 1984)			
6	*See* LBL-18136	DE84016891	MN -34A	9:46199
7	*See* LBL-18135	DE84016893	MN -25	9:46243
CONF-840881-	(International conference on optical effects in amorphous semiconductors, Snowbird, UT, USA, 1-4 Aug 1984)			
1	*See* BNL-35144	DE84016993	MN -25	9:46241
CONF-840882-	(International symposium on heavy ion physics, Mt. Fuji, Japan, 27-31 Aug 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016231	MN -34	9:46999
CONF-840887-	(16. international congress on high speed photography and photonics, Strasbourg, France, 27-31 Aug 1984)			
2	*See* UCRL-90494	DE84016170	MN -37	9:46512
4	*See* UCRL-90491	DE84016195	MN -38	9:46531
6	*See* LA-UR-84-2654	DE84016461	MN -37	9:46524
7	*See* LA-UR-84-2696	DE84016783	MN -37	9:46526
8	*See* LA-UR-84-2676	DE84016465	MN -37	9:46525
9	*See* LA-UR-84-2598	DE84016823	MN -37	9:46523
10	*See* LA-UR-84-2540	DE84016477	MN -37	9:46522
CONF-840888-	(ASCE Hydraulics Division specialty conference, Coeur d'Alene, ID, USA, 14-17 Aug 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016594	MN -11	9:46606
CONF-840890-	(Impact of mining on groundwater conference, Denver, CO, USA, 27-29 Aug 1984)			
1	*See* SAND-84-1728C	DE84016221	MN -51	9:45494
CONF-840892-	(Yamada conference on dislocations in solids, Tokyo, Japan, 27-31 Aug 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016703	MN -25	9:46181
CONF-840897-	(21. International Union of Radio Science general assembly, Florence, Italy, 28 Aug-5 Sep 1984)			
1	*See* UCRL-91423	DE84017052	MN -37	9:46534
CONF-840898-	(Symposium on research and monitoring in circumpolar biosphere reserves, Alberta, Canada, 27-31 Aug 1984)			
1	*See* EGG-M-16784	DE84016996	MN -11	9:46568
CONF-840899-	(5. international symposium on gas flow and chemical lasers, Oxford, UK, 20 Aug 1984)			
1	*See* LA-UR-84-2620	DE84016827	MN -37	9:46356
2	*See* LA-UR-84-2555	DE84016476	MN -21	9:47124
CONF-8408100-	(Conference on vector and parallel processors in computational science II, Oxford, UK, 28-31 Aug 1984)			
1	*See* LA-UR-84-2609	DE84016825	MN -32	9:47229

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CONF-8408101-	(1. international symposium on solubility phenomena, London, Ontario, Canada, 21-23 Aug 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016701	MN -4	9:46283
CONF-8408102-	(Joint Council on Forest Engineering/International Union of Forestry Research Organizations symposium, Orono, ME, USA, 12-14 Aug 1984)			
1	*See* SERI/TP-215-2220	DE84013030	STD -61A	9:45707
CONF-8408103-	(1. world conference on robotics research, Bethlehem, PA, USA, 14-16 Aug 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016609	MN -38	9:46436
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016563	MN -38	9:46437
CONF-840906-	(Capture gamma-ray spectroscopy conference, Knoxville, TN, USA, 10-14 Sep 1984)			
1	*See* LA-UR-84-2711	DE84016799	MN -34D	9:46935
CONF-840910-	(10. international conference on plasma physics and controlled nuclear fusion research, London, UK, 12-19 Sep 1984)			
8-Rev.1	*See* UCRL-90396-Rev.1	DE84017029	MN -21	9:47087
9	*See* DOE/ET/53051-70	DE84016650	STD -20f	9:47069
11	*See* UCRL-90558	DE84016227	MN -21	9:47134
13	*See* LA-UR-84-2690	DE84016467	MN -20	9:47071
CONF-840914-	(International meeting on thermal nuclear reactor safety, Karlsruhe, F.R. Germany, 10-14 Sep 1984)			
5	*See* UCRL-91369	DE84016228	MN -78	9:46027
6	*See* SAND-84-0320C	DE84016791	MN -80	9:46018
7	*See* SAND-83-2630C	DE84016765	MN -78	9:46016
8	*See* SAND-84-0518C	DE84016787	MN -78	9:46019
9	*See* SAND-84-0056C	DE84016786	MN -78	9:46017
10	*See* UCRL-90410	DE84017099	MN -80	9:46026
11	*See* SAND-83-2594C	DE84016936	MN -78	9:46015
12	*See* SAND-84-0522C	DE84017004	MN -80	9:46020
CONF-840915-	(13. symposium on fusion technology, Varese, Italy, 24-28 Sep 1984)			
1	*See* UCRL-90619	DE84017091	MN -20	9:47135
CONF-840930-	(OCEANS '84 conference and exposition, Washington, DC, USA, 10-12 Sep 1984)			
2	*See* SERI/TP-252-2330	DE84013011	MN -64	9:45741
CONF-840945-	(Topical conference on neutron-nucleus collisions--a probe of nuclear structure, Glouster, OH, USA, 5-8 Sep 1984)			
1	*See* UCRL-91217	DE84017049	MN -34C	9:46963
2	*See* UCRL-91455	DE84017003	MN -34C	9:46936
CONF-840954-	(9. national passive solar conference, Columbus, OH, USA, 23-27 Sep 1984)			
2	*See* LA-UR-85-2639	DE84016829	MN -59b	9:45758
3	*See* LA-UR-84-2565	DE84016749	MN -59a	9:45752
CONF-8409107-	(5. international conference on rapidly-quenced metals, Wurzburg, F.R. Germany, 3-7 Sep 1984)			
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016856	MN -25	9:46182
CONF-8409108-	(IEEE-IAS meeting, Chicago, IL, USA, 30 Sep-4 Oct 1984)			
3	*See* LBL-18087	DE84016898	MN -95f	9:46128
4	*See* LBL-17927	DE84016889	MN -95f	9:46126
5	*See* LBL-17998	DE84016902	MN -95d	9:46127
CONF-8409109-	(Industrial temperature measurement symposium, Knoxville, TN, USA, 10-12 Sep 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016855	MN -37	9:46517
3	*See* SAND-84-0895C	DE84016789	MN -38	9:46530
CONF-8409117-	(2. international conference on the science of hard materials, Rhodes, Greece, 23-28 Sep 1984)			
2	*See* UCRL-90189	DE84017032	MN -25	9:46235
CONF-8409118-	(Passive and hybrid solar energy update, Washington, DC, USA, 5-7 Sep 1984)			
1	*See* LA-UR-84-2650	DE84016830	MN -59b	9:45753
2	*See* LA-UR-84-2736	DE84016772	MN -59b	9:45757
3	*See* LA-UR-84-2735	DE84016771	MN -59b	9:45756
4	*See* LA-UR-84-2725	DE84016794	MN -59b	9:45755
5	*See* LA-UR-84-2724	DE84016793	MN -59b	9:45754
CONF-8409122-	(Quadrennial ozone symposium, Halkidiki, Greece, 3-7 Sep 1984)			
2	*See* UCRL-90297	DE84017028	MN -11	9:46574
CONF-8409125-	(International aerosol conference, Minneapolis, MN, USA, 17-21 Sep 1984)			
1	*See* SAND-84-0200C	DE84016169	MN -45	9:46442
CONF-8409127-	(6. international colloquium on the optimization of plant nutrition, Montpellier, France, 2-8 Sep 1984)			
1	*See* LA-UR-84-2571	DE84016820	MN -11	9:46676
2	*See* LA-UR-84-2570	DE84016814	MN -11	9:46735
CONF-8409129-	(3. international conference on multiphoton processes, Iraklion, Crete, Greece, 4-11 Sep 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017454	MN -34A	9:46847
CONF-841008-	(Nuclear power systems symposium, Orlando, FL, USA, 31 Oct-2 Nov 1984)			
1	*See* LBL-17378	DE84016894	MN -38	9:46528
CONF-841016-	(International conference on occupational radiation safety in mining, Toronto, Ontario, Canada, 15-18 Oct 1984)			
2	*See* LA-UR-84-2698	DE84016784	MN -41	9:45662

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CONF-841049-	(5. AIC conference on the implementation and effectiveness of air infiltration standards in buildings, Reno, NV, USA, 1-4 Oct 1984)			
1	*See* LBL-18139	DE84016899	MN -95d	9:46129
CONF-841055-	(16. national SAMPE technical conference on materials and processes, Albuquerque, NM, USA, 9-11 Oct 1984)			
1	*See* LA-UR-84-2044	DE84014012	MN -25	9:46237
2	*See* LA-UR-84-2158	DE84015507	MN -13	9:47221
3	*See* BNL-35131	DE84016989	MN -25	9:46179
CONF-841059-	(3. American Meteorological Society conference on mountain meteorology, Portland, OR, USA, 15-19 Oct 1984)			
6	*See* UCRL-90795	DE84014713	MN -11	9:46560
11	*See* BNL-35123	DE84016442	MN -11	9:46563
CONF-841076-	(9. international congress on rheology, Acapulco, Mexico, 8-13 Oct 1984)			
2	*See* LBL-17968	DE84014571	MN -25	9:46873
3	*See* LBL-17735	DE84016008	MN -25	9:46872
CONF-841099-	(Human Factors Society annual meeting, San Antonio, TX, USA, 22-26 Oct 1984)			
2	*See* SAND-84-1569C	DE84015215	MN -41	9:46021
CONF-8410101-	(6. autofact conference, Anaheim, CA, USA, 1-4 Oct 1984)			
1	*See* SAND-84-1202C	DE84013803	MN -32	9:46558
CONF-8410128-	(35. annual conference of the New Mexico Geological Society, Taos, NM, USA, 10-13 Oct 1984)			
1	*See* LA-UR-84-2114	DE84015492	MN -11	9:46764
CONF-8410134-	(21. annual meeting of the Society of Engineering Science, Blacksburg, VA, USA, 15-17 Oct 1984)			
1	*See* SAND-84-0209C	DE84017152	MN -90b	9:45352
CONF-841201-	(ASME winter annual meeting, New Orleans, LA, USA, 9-13 Dec 1984)			
14	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016233	MN -20	9:47117
COO-				
1599-257-Pt.1	*See* DOE/EV/01599-257-Pt.1	DE84016909	MN -11	9:46600
2218-307	*See* DOE/ET/52040-T21	DE84017447	MN -20	9:47064
3235-91	*See* DOE/ER/03235-91	DE84017343	MN -34C	9:47015
3496-79	*See* DOE/ER/03496-79	DE84016629	MN -34C	9:46926
4255-3	*See* DOE/EV/04255-3	DE84017629	MN -66e	9:45878
4355-8	*See* DOE/ET/26214-T3	DE84017302	MN -38	9:46186
4355-9	*See* DOE/ET/26214-T2	DE84017653	MN -38	9:46185
4831-7	*See* DOE/ER/04831-7	DE84017424	MN -34D	9:46979
DGMK-				
294	Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlechemie e.V., Hamburg (Germany, F.R.)			9:46608
DOE/AL/19929-				
T8	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017445	MN -62	9:45714
T9	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017446	MN -62	9:45739
DOE/BC/10310-				
34	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84017404	STD -92a	9:45424
DOE/BC/10704-				
8	NTIS, PC A21/MF A01 (GPO Dep.)	DE84015848	STD -92a	9:45425
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84/ 1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84012763	STD -92a	9:45426
245	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84016392	MN -11	9:46619
248	NTIS, PC A16/MF A01; 1 (GPO Dep.)	DE84016656	MN -11	9:46620
266	NTIS, PC A08/MF A01; 1	DE84016651	MN -97e	9:45710
285	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017143	MN -95	9:46103
286	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017158	MN -95	9:46117
288	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017141	MN -11	9:46065
289	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84016998	MN -11	9:46066
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0016/ 3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016388	STD -95	9:46080
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T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84015914	MN -59	9:45746
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1	NTIS, PC A99/MF A01; 1 (GPO Dep.)	DE84017157	MN -97c	9:45923
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T6	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016958	MN -96	9:46173
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26	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84009473	MN -59c	9:46104
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T1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84016337	STD -59b	9:45747
DOE/CS/30531-				
T1	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84015629	MN -59b	9:46118
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T1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84011488	STD -59a	9:45774
DOE/CS/62143-				
T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84016907	MN -95	9:46119
DOE/CS/69105-				
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017576	MN -95	9:46120
DOE/DP/40171-				
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017412	MN -20f	9:47063
DOE/EIA-				
0035(84/ 05)	NTIS, PC A07/MF A01; 1 - GPO (GPO Dep.)	DE84016616	MN -98	9:45445
0130(84/ 06)	NTIS, PC A08/MF A01; 1 - GPO (GPO Dep.)	DE84016489	MN -98C	9:45480
0226(84/ 06)	NTIS, PC A03/MF A01; 1 - GPO (GPO Dep.)	DE84017484	MN -98	9:46091

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0354(82/ 2)	NTIS, PC A20/MF A01 - GPO (GPO Dep.)	DE84017043	MN -98	9:46056
0380(84/ 06)	NTIS, PC A07/MF A01; 1 - GPO (GPO Dep.)	DE84017154	MN -98B	9:45446
0380(84/ 06)	NTIS, PC A07/MF A01 - GPO (GPO Dep.)	DE84017220	MN -98B	9:45447
0452	NTIS, PC A16/MF A01; 1 - GPO (GPO Dep.)	DE84017444	MN -98B	9:45404
0454	NTIS, PC A04/MF A01; 1 - GPO (GPO Dep.)	DE84017572	MN -98	9:45448
0456	NTIS, PC A04/MF A01; 1 - GPO (GPO Dep.)	DE84017153	MN -98	9:46088
0492	NTIS, PC A09/MF A01; 1 - GPO (GPO Dep.)	DE84017571	MN -98A	9:45306
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0197	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017145	MN -20a	9:47118
0199	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017390	MN -20	9:47119
DOE/ER/00854-				
42	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017041	MN -4	9:46261
DOE/ER/02853-				
22	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017448	MN -34D	9:46925
23	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016803	MN -34C	9:46951
DOE/ER/03235-				
91	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017343	MN -34C	9:47015
DOE/ER/03496-				
79	NTIS, PC A21/MF A01; 1 (GPO Dep.)	DE84016629	MN -34C	9:46926
DOE/ER/04215-				
T2	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84017427	MN -34C	9:46927
DOE/ER/04831-				
7	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017424	MN -34D	9:46979
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T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017423	MN -4	9:46262
DOE/ER/10533-				
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84016338	MN -61G	9:45717
DOE/ER/10612-				
11	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84016752	MN -4	9:46284
DOE/ER/10622-				
5	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017264	MN -4	9:46263
DOE/ER/10689-				
4	NTIS, PC A03/MF A01 (GPO Dep.)	DE84016491	MN -4	9:46285
DOE/ER/10861-				
T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016798	MN -4	9:46310
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149	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017280	MN -25	9:46183
150	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017281	MN -25	9:46184
DOE/ER/10915-				
4	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017084	MN -25	9:46229
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1	NTIS, PC A19/MF A01; 1	DE84003020	MN -38	9:46369
DOE/ER/10968-				
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017110	MN -4	9:46311
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3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016255	MN -4	9:46341
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40	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84016613	MN -34C	9:47016
DOE/ER/13048-				
1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84017401	STD -21	9:47120
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T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84010260	MN -34D	9:46928
DOE/ER/40132-				
T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017467	MN -34D	9:47017
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1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017096	MN -4	9:46625
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3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017031	MN -41	9:46644
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5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017426	MN -48	9:46645
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T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016801	MN -48	9:46646
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T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016914	MN -90c	9:45308
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T7	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84015824	MN -11	9:45378
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T29	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84016991	MN -61	9:45718
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178	NTIS, PC A17; 3	DE82017130	STD -63	9:45736
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T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017653	MN -38	9:46185
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T3	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84016817	MN -66	9:45809
T4	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017358	MN -66	9:45810
T5	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84017359	MN -66	9:45811
DOE/ET/29015-				
T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017610	MN -94b	9:46035
DOE/ET/32043-				
T20	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017623	MN -23	9:45671
DOE/ET/34014-				
15	NTIS (US Sales Only), PC A05/MF A01; 1 (GPO Dep.)	DE84017172	STD -78	9:45510

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DOE/ET/51013-111	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017159	STD -20	9:47121
DOE/ET/52040-T21	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84017447	MN -20	9:47064
DOE/ET/53003-1	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017266	MN -20	9:47065
DOE/ET/53016-T4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016470	MN -20	9:47066
T5	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016471	MN -20	9:47067
DOE/ET/53051-69	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84017345	STD -20f	9:47068
70	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016650	STD -20f	9:47069
DOE/EV/01599-257-Pt.1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84016909	MN -11	9:46600
DOE/EV/02040-16	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017232	MN -48	9:46685
DOE/EV/02270-8	NTIS, PC A02; 3 (GPO Dep.)	DE84015885	MN -48	9:46673
DOE/EV/02386-23	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017342	MN -48	9:46566
DOE/EV/03018-252	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017135	MN -4	9:46318
257	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84016385	MN -4	9:46257
DOE/EV/03264-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017341	MN -48	9:46670
DOE/EV/03280-T2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015846	MN -48	9:46629
DOE/EV/03490-2077	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84016270	MN -48	9:46731
2113	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84016268	MN -48	9:46626
2264	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84016251	MN -48	9:46732
DOE/EV/04255-3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017629	MN -66e	9:45878
DOE/EV/04957-4	NTIS, PC AA08/MF A01 (GPO Dep.)	DE83015829	MN -41	9:46498
DOE/EV/10326-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017097	MN -48	9:46627
DOE/EV/10402-T3	NTIS, PC A03/MF A01 (GPO Dep.)	DE84016788	MN -48	9:46647
DOE/EV/10680-T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016244	MN -11	9:46759
DOE/EV/14377-5	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017209	MN -48	9:46726
T2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017207	MN -48	9:46727
T3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017205	MN -48	9:46728
DOE/FE-0037/ 2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017498	MN -92	9:45456
0043	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017402	MN -92a	9:45427
60181-73	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016952	MN -90	9:45926
DOE/FE/00016-T56	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016959	MN -88	9:45380
DOE/ID/12478-T3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016295	MN -66g	9:45896
T4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017363	MN -66c	9:45882
DOE/IG-0208	TIC; 1	TI84016925	STD -13	9:47216
DOE/JPL-1012-89	NTIS, PC A22/MF A01; 1	DE84001225	STD -63b	9:45719
DOE/JPL/954739-84/ 06	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017101	STD -63b	9:45720
DOE/JPL/955567-84-15	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017322	STD -63b	9:45721
DOE/JPL/956741-84/ 02	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017384	STD -63	9:45722
DOE/MC/08704-T1	NTIS, PC A06/MF A01 (GPO Dep.)	DE84017560	MN -90i	9:45362
DOE/MC/08705-T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017559	MN -91	9:45471
DOE/MC/08710-T1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84017557	MN -91	9:45482
DOE/MC/08712-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017597	MN -90i	9:45403
DOE/MC/08715-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017584	MN -90i	9:46733
DOE/MC/08718-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017585	MN -90i	9:45363
DOE/MC/08722-T1	NTIS, PC A07/MF A01 (GPO Dep.)	DE84017582	MN -90c	9:45309
DOE/MC/08723-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017581	MN -91	9:45349
DOE/MC/08725-T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017586	MN -91	9:45472
DOE/MC/11448-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017587	MN -90a	9:45396

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DOE/MC/14129-1646	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84012009	STD -90e	9:46445
DOE/MC/19168-T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017393	MN -90c	9:45310
DOE/MC/19210-T1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84017262	MN -90a	9:45350
DOE/MC/20037-1644	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84016323	STD -92	9:45414
DOE/MC/20700-1635	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017566	STD -90b	9:45387
DOE/METC-84/4	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84003075	MN -90c	9:45311
84-26-Vol.1	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84011958	STD -90h	9:45364
84-26-Vol.2	NTIS, PC A15/MF A01; 1 (GPO Dep.)	DE84012007	STD -90h	9:45365
DOE/METC/SP-211	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009249	STD -92a	9:45473
DOE/NASA-0302-1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84016861	STD -96	9:46141
0304-1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85001608	STD -96	9:46161
0354-2	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84016961	STD -60	9:45912
2674-78/2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017134	MN -90g	9:46111
DOE/NBM-4016402	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016402	MN -11	9:46067
4016403	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016403	MN -11	9:46068
4016404	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016404	MN -11	9:46069
4016405	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016405	MN -11	9:46070
4016406	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016406	MN -11	9:46071
4016407	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016407	MN -11	9:46072
4016408	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016408	MN -11	9:46073
4016409	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016409	MN -11	9:46059
4016410	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016410	MN -11	9:46074
4016411	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84016411	MN -11	9:46075
4016413	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016413	MN -11	9:46076
4016414	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016414	MN -11	9:46077
4017488	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017488	MN -34A	9:46848
4017489	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017489	MN -34	9:47032
DOE/NV/00410-T3	NTIS, PC A04/MF A01 (GPO Dep.)	DE84016689	MN -41	9:46499
DOE/NV/10162-15	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84017019	MN -70	9:45649
DOE/NV/10174-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016279	MN -66e	9:45879
DOE/OR/00033-T74	NTIS, PC A06/MF A01 (GPO Dep.)	DE84017138	MN -20	9:47122
DOE/OR/03054-18	NTIS, PC A15/MF A01; 1 (GPO Dep.)	DE84011293	STD -89	9:45312
48-Vol.2	NTIS, PC A25/MF A01; 1 (GPO Dep.)	DE84015373	STD -89	9:45313
53	NTIS, PC A05/MF A01 (GPO Dep.)	DE84017406	STD -89	9:45314
64	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84017014	STD -89	9:45315
65-Vol.1A	NTIS, PC A04/MF A01 (GPO Dep.)	DE84013633	STD -89	9:45316
73	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017011	STD -89	9:45317
97	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017013	STD -89	9:45318
106	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017012	STD -89	9:45319
112	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017420	STD -89	9:45321
DOE/OR/20722-19	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84017187	STD -70A	9:45660
DOE/OR/21390-3	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84016326	MN -61F	9:46105
DOE/OR/21400-1	NTIS, PC A08/MF A01 (GPO Dep.)	DE84016858	STD -11	9:46567
T41	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84016569	MN -25	9:46187
T42	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84016559	MN -98D	9:46106
T43	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017377	MN -32	9:47228
DOE/PC/40077-T7	NTIS, PC A17/MF A01; 1 (GPO Dep.)	DE84017230	STD -90d	9:45688
DOE/PC/50796-T6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016292	MN -90a	9:46295
DOE/PC/60778-3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017321	STD -90d	9:45322
DOE/PC/60785-4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016013	STD -90d	9:45351
DOE/PC/60807-4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016199	MN -90a	9:46264
DOE/PO/10850-T2	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017496	STD -92	9:45457
DOE/R5/10230-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016953	MN -59b	9:45748
DOE/R5/10275-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84016277	MN -97e	9:45708
DOE/R8/07227-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84015412	MN -95	9:46081
DOE/R8/08005-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015778	MN -59a	9:45749
DOE/R8/08028-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015782	MN -59b	9:45750

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DOE/R8/08031-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015787	MN -59a	9:45751
DOE/RA/12117-4	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84016962	STD -97e	9:45709
DOE/RA/50403-1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84012066	STD -95e	9:46157
DOE/RC/11849-T1-Vol.1	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84016854	MN -98	9:46092
T1-Vol.2	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84016853	MN -98	9:46093
DOE/S-0019/ 1	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017142	MN -70	9:45528
0031	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017284	MN -13	9:47217
DOE/SF/01424-51	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84017405	STD -92a	9:45428
DOE/SF/10501-064	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84017038	MN -62a	9:45740
DOE/SF/11509-T2	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84015312	MN -11	9:46787
DOE/SF/11611-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84014962	STD -60	9:45913
DOE/SF/12197-1	NTIS, PC A03/MF A01 (GPO Dep.)	DE84016370	MN -66a	9:45886
DOE/SR/00001-T39	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013161	MN -15	9:45529
DP-66-2-6	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016870	MN -23	9:45674
1688	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001772	STD -4	9:45500
DS/PH-83-1	*See* AD-A-140653/7			9:46553
E-1776	*See* N-84-13670			9:45909
ECN-142	NTIS (US Sales Only), PC A05/MF A01	DE84702886	MN -34C	9:46973
147	NTIS (US Sales Only), PC A11/MF A01	DE84702893	MN -4	9:46265
152	NTIS (US Sales Only), PC A03/MF A01	DE84702913	MN -25	9:46188
153	NTIS (US Sales Only), PC A03/MF A01	DE84702829	MN -46	9:46500
EES-0035-1	*See* MTR-7693	DE84014770	MN -95a	9:46083
EGG-2328	*See* NUREG/CR-3921	TI84017465	MN -85	9:45514
2344	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017455	MN -95f	9:46142
EGG/10282-2031	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017360	MN -70	9:45650
EGG-HS-6185	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84016486	MN -78	9:45990
EGG-M-00884	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016347	MN -78	9:45991
06984	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017237	MN -20d	9:46189
09884	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017015	MN -66a	9:45883
10184	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017008	MN -66a	9:45884
10284	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017009	MN -66g	9:45897
10584	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016218	MN -78	9:45992
12384	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014636	MN -34C	9:47005
16784	NTIS, PC A03/MF A01 (GPO Dep.)	DE84016996	MN -11	9:46568
24183	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017018	MN -93	9:46113
24283	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017017	MN -38	9:46121
24383	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016995	MN -38	9:46143
24483	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017016	MN -38	9:46144
25883	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017065	MN -86	9:45504
EGG-TIO-M-0284	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016216	MN -78	9:45993
0384	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016217	MN -78	9:45994
EML-430	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84017246	STD -11	9:46579
ENDF-337	*See* ORNL/TM-9083	DE84016578	MN -34C	9:46977
EPA/520/5-83-027	*See* PB-84-187269			9:46622
EPA/600/4-84-005	*See* PB-84-189935			9:46586
84-032	*See* PB-84-189968			9:46587
EPA/600/9-84-004	*See* PB-84-194562			9:46588
EPA-AA-TEB-84-2	*See* PB-84-183110			9:46168
EPRI-CS-3511	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920519	ND -90e	9:46425
EPRI-EA-3221-Vol.2	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920485	ND -11	9:46609
3587	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920503	ND -97	9:46094
EPRI-EL-3502	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920476	ND -97b	9:45927
3624	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920474	ND -97a	9:45928
EPRI-EM-3627	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920529	ND -95d	9:46122

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3645	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920528	ND -95f	9:46145
EPRI-NP-				
3635	NTIS, PC A05/MF A01 - EPRI (GPO Dep.)	DE84016276	MN -78	9:45995
ERA-				
81-139	*See* ERATL-84/30/2			9:46147
81-140	*See* ERATL-84/30/4			9:46149
82-39	*See* ERATL-84/30/3			9:46148
82-112	*See* ERATL-84/30/1			9:46438
ERATL-				
84/ 30	NTIS PC $1,500.00			9:46146
84/ 30/ 1	NTIS PC $1,500.00			9:46438
84/ 30/ 2	NTIS PC $1,500.00			9:46147
84/ 30/ 3	NTIS PC $1,500.00			9:46148
84/ 30/ 4	NTIS PC $1,500.00			9:46149
ERP/ERL-				
81-55(TR)	Department of Energy, Mines and Resources, Energy Research Labs., Ottawa, Ontario, Canada			9:45397
ERP/MSL-				
83-121(TR)	Department of Energy, Mines and Resources, Mineral Sciences Labs., Ottawa, Ontario, Canada			9:45366
ESG-				
3519	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016293	MN -90a	9:45367
EUR-				
8853-EN	Commission of the European Communities, Luxembourg			9:45781
FAO-AG/DP/GRE-				
77/ 023-Vol.1	NTIS (US Sales Only), PC A11/MF A01; Also available from FAO 8218413	DE84702929	MN -11	9:46760
77/ 023-Vol.2	NTIS (US Sales Only), PC A12/MF A01	DE84702930	MN -11	9:46761
FE-				
1514-38	*See* DOE/ET/10161-T1	DE84016914	MN -90c	9:45308
FEI-				
1338	NTIS (US Sales Only), PC A02/MF A01	DE84702906	MN -25	9:46190
1391	NTIS (US Sales Only), PC A02/MF A01	DE84702830	MN -46	9:47033
1418	NTIS (US Sales Only), PC A02/MF A01	DE84702948	MN -38	9:46413
1423	NTIS (US Sales Only), PC A02/MF A01	DE84702864	MN -34C	9:46968
FERC/DEIA-				
0001	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84015549	MN -97e	9:45711
FNAL-TM-				
1270	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016715	MN -34C	9:46501
1277	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015639	MN -28	9:46460
FR-				
84-35/ ASC	NTIS, PC A03/MF A01 (GPO Dep.)	DE84016521	MN -62b	9:45775
FRNC-TH-				
1516	NTIS (US Sales Only), PC A07; 3	DE84751845	MN -63	9:45723
1648	NTIS (US Sales Only), PC A08/MF A01; 1	DE84751848	MN -61D	9:45678
1650	NTIS (US Sales Only), PC A07/MF A01; 1	DE84751847	MN -63	9:45724
1652	NTIS (US Sales Only), PC A05/MF A01; 1	DE84751844	MN -94e	9:46038
1653	NTIS (US Sales Only), PC A07/MF A01; 1	DE84751849	MN -61D	9:45690
1655	NTIS (US Sales Only), PC A05/MF A01; 1	DE84751846	MN -94e	9:46039
FTD-ID(RS)T-				
0031-84	*See* N-8423283			9:46440
0569-83	*See* N-84-12890			9:46359
1821-83	*See* N-8424336			9:46457
FWS/OBS-				
80/ 40.3	NTIS, PC A09/MF A01	TI84901620	MN -11	9:46590
80/ 40.4	GPO*	TI84901684	MN -11	9:46610
80/ 40.7	NTIS, PC A04/MF A01 - GPO*	TI84901656	MN -11	9:46591
80/ 40.8	NTIS, PC A03/MF A01 - GPO*	TI84901670	MN -11	9:46592
80/ 40.9	NTIS, PC A03/MF A01 - GPO*	TI84901671	MN -11	9:46593
80/ 40.11	NTIS, PC A04/MF A01 - GPO*	TI84901667	MN -48	9:46734
83/ 05	NTIS, PC A09/MF A01	TI84901351	MN -11	9:46601
GAO/AFMD-				
84-8	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901530	MN -13	9:47218
GAO/GGD-				
84-15	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760	TI84901897	MN -92	9:45452
GAO/RCED-				
83-118	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901107	MN -13	9:47219
84-1	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901892	MN -96	9:45702
84-12	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901517	MN -92a	9:45458
84-51	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901490	MN -92a	9:45453
84-52	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901532	MN -92	9:45454
84-91	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901898	MN -11	9:46060
84-100	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901874	MN -41	9:46061
84-102	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901873	MN -92	9:45486

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84-128	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901518	MN -13	9:47220
84-135	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760	TI84901894	MN -98C	9:46089
84-146	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901519	MN -11	9:46062
84-148	US General Accounting Office, Document Handling and Information Services Facility, P.O. Box 6015, Gaithersburg, MD 20760	TI84901491	MN -92a	9:45459
84-152	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901486	MN -11	9:46063
84-167	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760	TI84901893	MN -90j	9:45400
84-182	US General Accounting Office, Document Handling and Information Services Facility, P.O. Box 6015, Gaithersburg, MD 20760	TI84901872	MN -92	9:45460
84-187	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI84901870	MN -91	9:45489
GEPP-TIS-				
763	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017059	MN -13	9:46242
833	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017163	MN -13	9:46230
GJBX-				
6(84)	US Geological Survey-Open-File Services Section, P.O. Box 25046, Federal Center, Denver, CO 80225	TI84016744	ND -51	9:45490
HEDL-TME-				
84-13	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84017202	STD -20	9:47123
HIG-				
80-8	NTIS, PC A04/MF A01; 1	DE84901908	MN -11	9:46769
HW-				
28690	NTIS, PC A02; 3 (GPO Dep.)	DE84016686	MN -10	9:45505
31999	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84016685	MN -80	9:45964
IAE-				
3533/ 14	NTIS (US Sales Only), PC A02/MF A01	DE84702950	MN -28	9:46502
3646/ 2	NTIS (US Sales Only), PC A02/MF A01	DE84702865	MN -34C	9:47006
3713/ 1	NTIS (US Sales Only), PC A03/MF A01	DE84702820	MN -34D	9:46894
IAEA-RL-				
81	NTIS (US Sales Only), PC A03/MF A01	DE84702931	MN -11	9:46618
IFIN-CS-				
7-1983	NTIS (US Sales Only), PC A02/MF A01	DE84702894	MN -4	9:46327
IFIN-FT-				
213-1982	NTIS (US Sales Only), PC A03/MF A01	DE84702819	MN -34D	9:46895
IFIN-HE-				
105-1982	NTIS (US Sales Only), PC A02/MF A01	DE84702853	MN -34C	9:46952
106-1982	NTIS (US Sales Only), PC A02/MF A01	DE84702821	MN -34D	9:46896
IFIN-NP-				
24-1982	NTIS (US Sales Only), PC A02/MF A01	DE84702946	MN -23	9:46605
25-1983	NTIS (US Sales Only), PC A02/MF A01	DE84702826	MN -34D	9:46883
IFIN-RB-				
8-1982	NTIS (US Sales Only), PC A02/MF A01	DE84702897	MN -4	9:46266
9-1982	NTIS (US Sales Only), PC A02/MF A01	DE84702905	MN -4	9:46328
10-1982	NTIS (US Sales Only), PC A02/MF A01	DE84702895	MN -4	9:46329
11-1983	NTIS (US Sales Only), PC A02/MF A01	DE84702937	MN -48	9:46753
IFTM-CS-				
6-1982	NTIS (US Sales Only), PC A05/MF A01	DE84702909	MN -25	9:46191
IFVE-OTF-				
83-23	NTIS (US Sales Only), PC A02/MF A01	DE84702822	MN -34D	9:46897
IFVE-OUNK-OEA-				
82-204	NTIS (US Sales Only), PC A02/MF A01	DE84702951	MN -28	9:46503
IMMR-				
82-065	University of Kentucky, Inst. for Mining and Minerals Research, Lexington (USA)			9:45368
INDC-				
39/ U	NTIS (US Sales Only), PC A06/MF A01	DE84702880	MN -34C	9:46929
INDC(BZL)-				
9/ GIJV	NTIS (US Sales Only), PC A02/MF A01	DE84702889	MN -34C	9:47007
INDC(CCP)-				
208/ L	NTIS (US Sales Only), PC A02/MF A01	DE84702884	MN -34C	9:46969
209/ L	NTIS (US Sales Only), PC A02/MF A01	DE84702885	MN -34C	9:46970
210/ L	NTIS (US Sales Only), PC A02/MF A01	DE84702887	MN -34C	9:46930
211/ L	NTIS (US Sales Only), PC A02/MF A01	DE84702890	MN -34C	9:47008
216/ LI	NTIS (US Sales Only), PC A05/MF A01	DE84702879	MN -34C	9:46267
217/ LI	NTIS (US Sales Only), PC A04/MF A01	DE84702858	MN -34C	9:47018
INDC(EGY)-				
004/ L	NTIS (US Sales Only), PC A02/MF A01	DE84702831	MN -46	9:47034
INDC(JPN)-				
85/ GL	*See* JAERI-M-84-052	TI84901546	ND -34C	9:46931
86/ GL	*See* JAERI-M-84-103	TI84901548	ND -34C	9:46932
INDC(NDS)-				
147/ GE	NTIS (US Sales Only), PC A03/MF A01	DE84702891	MN -34C	9:47009
149/ NE	NTIS (US Sales Only), PC A03/MF A01	DE84702892	MN -34C	9:47010
153/ L	NTIS (US Sales Only), PC A03/MF A01	DE84702882	MN -34C	9:46474
INIS-mf-				
8786	NTIS (US Sales Only), PC A04/MF A01	DE84780593	MN -48	9:46648
8791	NTIS (US Sales Only), PC A05/MF A01	DE84780594	MN -48	9:46649
8792	NTIS (US Sales Only), PC A05/MF A01	DE84780601	MN -48	9:46650

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8795	NTIS (US Sales Only), PC A07/MF A01	DE84780602	MN -48	9:46651
8797	NTIS (US Sales Only), PC A07/MF A01	DE84780611	MN -80	9:45979
8799	NTIS (US Sales Only), PC A04/MF A01	DE84780595	MN -48	9:46652
8801	NTIS (US Sales Only), PC A06/MF A01	DE84780596	MN -48	9:46653
8809	NTIS (US Sales Only), PC A04/MF A01	DE84780597	MN -48	9:46654
8812	NTIS (US Sales Only), PC A03/MF A01	DE84780603	MN -48	9:46655
8841	NTIS (US Sales Only), PC A03/MF A01	DE84780604	MN -48	9:46656
8850	NTIS (US Sales Only), PC A06/MF A01	DE84780598	MN -48	9:46657
8851	NTIS (US Sales Only), PC A05/MF A01	DE84780605	MN -48	9:46658
8852	NTIS (US Sales Only), PC A06/MF A01	DE84780599	MN -48	9:46659
8861	NTIS (US Sales Only), PC A19/MF A01	DE84780509	MN -97	9:46520
8881	NTIS (US Sales Only), PC A22/MF A01	DE84780610	MN -80	9:45972
8885	NTIS (US Sales Only), PC A02/MF A01	DE84780607	MN -35	9:46557
8889	NTIS (US Sales Only), PC A02/MF A01	DE84780612	MN -78	9:45996
9034	NTIS (US Sales Only), PC A02/MF A01	DE84780606	MN -23	9:45672
9040	NTIS (US Sales Only), PC A15/MF A01	DE84780568	MN -70	9:45531
9046	NTIS (US Sales Only), PC A06/MF A01	DE84780609	MN -28	9:46521
9047	NTIS (US Sales Only), PC A07/MF A01	DE84780613	MN -37	9:46505
9050	NTIS (US Sales Only), PC A14/MF A01	DE84780600	MN -48	9:46660
INIS-SU-				
248	NTIS (US Sales Only), PC A05/MF A01	DE84780608	MN -28	9:46451
INT-				
(84) -1	*See* INDC(BZL)-9/GIJV	DE84702889	MN -34C	9:47007
IPPJ-				
640	*See* N-84-12916			9:47074
642	*See* N-84-12909			9:47125
643	*See* N-84-12910			9:47126
IPPJ-AM-				
29	*See* N-84-12913			9:47073
30	*See* N-84-12912			9:46852
31	*See* N-84-12911			9:47072
IRNE-				
151-1982	NTIS (US Sales Only), PC A03/MF A01	DE84702910	MN -25	9:46192
153-1982	NTIS (US Sales Only), PC A02/MF A01	DE84702911	MN -25	9:46193
154-1982	NTIS (US Sales Only), PC A02/MF A01	DE84702832	MN -46	9:47035
155-1982	NTIS (US Sales Only), PC A02/MF A01	DE84702833	MN -46	9:46507
IS-M-				
513	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014818	MN -25	9:46194
IS-T-				
260	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017126	MN -25	9:46195
437	NTIS, PC A04/MF A01 (GPO Dep.)	DE84016659	MN -4	9:46414
1097	NTIS, PC A14/MF A01; 1 (GPO Dep.)	DE84015476	MN -4	9:46268
ITEF-				
62(1983)	NTIS (US Sales Only), PC A02/MF A01	DE84702952	MN -28	9:46482
91(1983)	NTIS (US Sales Only), PC A03/MF A01	DE84702835	MN -34C	9:47019
148(1983)	NTIS (US Sales Only), PC A05/MF A01	DE84702866	MN -34C	9:46953
181(1983)	NTIS (US Sales Only), PC A02/MF A01	DE84702867	MN -34C	9:46980
ITEP-				
17(1983)	NTIS (US Sales Only), PC A03/MF A01	DE84702836	MN -34C	9:46937
93(1983)	NTIS (US Sales Only), PC A04/MF A01	DE84702859	MN -34C	9:46898
ITF-				
82-141-R	NTIS (US Sales Only), PC A02/MF A01	DE84702837	MN -34C	9:47020
82-165-R	NTIS (US Sales Only), PC A02/MF A01	DE84702838	MN -34C	9:47021
83-50-R	NTIS (US Sales Only), PC A02/MF A01	DE84702840	MN -34C	9:47022
83-91-R	NTIS (US Sales Only), PC A02/MF A01	DE84702841	MN -34C	9:47023
83-100-R	NTIS (US Sales Only), PC A02/MF A01	DE84702839	MN -34C	9:46954
ITP-				
82-112-E	NTIS (US Sales Only), PC A02/MF A01	DE84702842	MN -34C	9:46955
82-149-E	NTIS (US Sales Only), PC A02/MF A01	DE84702843	MN -34C	9:46956
JAERI-M-				
84-052	Information Section, Div. of Technical Information, JAERI, Tokai-mura, Naka-gun, Ibaraki-ken 319-11, Japan	TI84901546	ND -34C	9:46931
84-103	Information Section, Div. of Technical Information, JAERI, Tokai-mura, Naka-gun, Ibaraki-ken 319-11, Japan	TI84901548	ND -34C	9:46932
JINR-				
1-83-566	NTIS (US Sales Only), PC A02/MF A01	DE84702877	MN -34C	9:46938
6-83-617	NTIS (US Sales Only), PC A02/MF A01	DE84702878	MN -34C	9:46992
8-83-702	NTIS (US Sales Only), PC A02/MF A01	DE84702961	MN -28	9:46455
9-83-305	NTIS (US Sales Only), PC A02/MF A01	DE84702962	MN -28	9:46508
9-83-554	NTIS (US Sales Only), PC A02/MF A01	DE84702963	MN -28	9:46462
9-83-711	NTIS (US Sales Only), PC A02/MF A01	DE84702970	MN -28	9:46483
9-83-772	NTIS (US Sales Only), PC A02/MF A01	DE84702964	MN -28	9:46484
9-83-837	NTIS (US Sales Only), PC A02/MF A01	DE84702965	MN -28	9:46485
9-83-838	NTIS (US Sales Only), PC A02/MF A01	DE84702966	MN -28	9:46486
11-83-782	NTIS (US Sales Only), PC A02/MF A01	DE84702958	MN -28	9:46487
12-82-830	NTIS (US Sales Only), PC A02/MF A01	DE84702901	MN -4	9:46312
12-83-718	NTIS (US Sales Only), PC A02/MF A01	DE84702904	MN -4	9:46330
13-83-478	NTIS (US Sales Only), PC A02/MF A01	DE84702959	MN -28	9:46488
13-83-504	NTIS (US Sales Only), PC A02/MF A01	DE84702949	MN -35	9:46509
13-83-861	NTIS (US Sales Only), PC A02/MF A01	DE84702960	MN -28	9:46456
19-83-743	NTIS (US Sales Only), PC A02/MF A01	DE84702938	MN -48	9:46686
D-1-83-686	NTIS (US Sales Only), PC A02/MF A01	DE84702868	MN -34C	9:46884
E-1-83-234	NTIS (US Sales Only), PC A02/MF A01	DE84702869	MN -34C	9:46981
E-1-83-277	NTIS (US Sales Only), PC A02/MF A01	DE84702844	MN -34C	9:46982
E-1-83-449	NTIS (US Sales Only), PC A02/MF A01	DE84702827	MN -34D	9:46885

Report No.	Availability	Order No.	Distribution Category	Abstract No.
E-4-83-401	NTIS (US Sales Only), PC A02/MF A01	DE84702854	MN -34C	9:46983
E-4-83-684	NTIS (US Sales Only), PC A02/MF A01	DE84702845	MN -34C	9:47024
E-4-83-754	NTIS (US Sales Only), PC A02/MF A01	DE84702846	MN -34C	9:46993
E-9-83-608	NTIS (US Sales Only), PC A02/MF A01	DE84702953	MN -28	9:46463
R-1-83-96	NTIS (US Sales Only), PC A02/MF A01	DE84702828	MN -34D	9:46959
R-1-83-237	NTIS (US Sales Only), PC A02/MF A01	DE84702870	MN -34C	9:46984
R-1-83-481	NTIS (US Sales Only), PC A02/MF A01	DE84702871	MN -34C	9:46960
R-1-83-564	NTIS (US Sales Only), PC A02/MF A01	DE84702872	MN -34C	9:46985
R-1-83-568	NTIS (US Sales Only), PC A02/MF A01	DE84702873	MN -34C	9:46986
R-1-83-577	NTIS (US Sales Only), PC A02/MF A01	DE84702874	MN -34C	9:46974
R-3-83-634	NTIS (US Sales Only), PC A02/MF A01	DE84702876	MN -34C	9:46975
R-4-82-934	NTIS (US Sales Only), PC A02/MF A01	DE84702847	MN -34C	9:46994
R-4-83-279	NTIS (US Sales Only), PC A02/MF A01	DE84702860	MN -34C	9:46939
R-4-83-547	NTIS (US Sales Only), PC A02/MF A01	DE84702848	MN -34C	9:46940
R-4-83-600	NTIS (US Sales Only), PC A02/MF A01	DE84702849	MN -34C	9:46987
R-4-83-723	NTIS (US Sales Only), PC A02/MF A01	DE84702850	MN -34C	9:46995
R-4-83-814	NTIS (US Sales Only), PC A02/MF A01	DE84702851	MN -34C	9:46996
R-9-83-719	NTIS (US Sales Only), PC A02/MF A01	DE84702955	MN -28	9:46464
R-9-83-752	NTIS (US Sales Only), PC A02/MF A01	DE84702956	MN -28	9:46465
R-9-83-817	NTIS (US Sales Only), PC A02/MF A01	DE84702957	MN -28	9:46489
R-11-83-724	NTIS (US Sales Only), PC A02/MF A01	DE84702954	MN -28	9:46466
R-15-83-736	NTIS (US Sales Only), PC A02/MF A01	DE84702875	MN -34C	9:46976
K/TS-				
10-885	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017574	MN -22	9:45498
KFTI-				
82-37	NTIS (US Sales Only), PC A02/MF A01	DE84702816	MN -34D	9:46899
82-47	NTIS (US Sales Only), PC A02/MF A01	DE84702907	MN -25	9:46196
82-56	NTIS (US Sales Only), PC A02/MF A01	DE84702852	MN -34C	9:47025
KU-HCOE-FL2-R-				
83-16	NTIS (US Sales Only), PC A03/MF A01	DE84702914	MN -25	9:46197
L-				
15689	*See* N-84-13978			9:45728
LA-				
9445-PNTX-A	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84008061	MN -11	9:46763
9445-PNTX-D	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84008063	MN -11	9:46580
9445-PNTX-L	NTIS, PC A02/MF A01	DE84008071	MN -11	9:46064
9988-PR	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016975	STD -11	9:46581
10021-MS	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017076	STD -32	9:46415
10034-SR	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84016977	STD -33A	9:45675
10090-MS	*See* NUREG/CR-3845	TI84017104	MN -79k	9:46011
10129-MS	*See* NUREG/CR-3821	TI84017105	MN -80	9:46009
10130-PR	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84017073	STD -4	9:47214
10132-MS	*See* NUREG/CR-3822	TI84017113	MN -78	9:45934
10133-MS	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016979	STD -4	9:45501
10139-PR	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016984	STD -11	9:46770
10149-T	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84016974	STD -34A	9:46849
10150	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016976	STD -28	9:46467
10156-MS	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016980	STD -41	9:46755
10174-T	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84017074	STD -34C	9:46941
10183-M	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017075	STD -32	9:47070
10190-PR	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016973	STD -33A	9:45676
10191-SR	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84017083	STD -28	9:46490
LA-tr-				
84-27	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015896	MN -38	9:46542
84-32	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017192	MN -28	9:46472
84-34	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017217	MN -4	9:46293
84-35	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017218	MN -4	9:46294
84-38	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017188	MN -38	9:46435
LA-UR-				
84-1992	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014029	MN -34B	9:46839
84-2044	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014012	MN -25	9:46237
84-2114	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015492	MN -11	9:46764
84-2158	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015507	MN -13	9:47221
84-2262	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015426	MN -15	9:45666
84-2336-Rev.	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016488	MN -32	9:47051
84-2422	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015536	MN -59a	9:45776
84-2470	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016487	MN -37	9:46515
84-2479	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84016485	MN -80	9:45661
84-2480	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016484	MN -34D	9:46942
84-2481	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016483	MN -34D	9:46943
84-2492	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016482	MN -25	9:46231
84-2499	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016481	MN -48	9:46661
84-2505	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016480	MN -34D	9:46900
84-2517	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84016479	MN -34B	9:46796
84-2531	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016478	MN -38	9:46449
84-2540	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016477	MN -37	9:46522
84-2555	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016476	MN -21	9:47124
84-2564	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84016475	MN -66b	9:45858
84-2565	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016749	MN -59a	9:45752
84-2570	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016814	MN -11	9:46735
84-2571	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016820	MN -11	9:46676
84-2593	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016816	MN -38	9:46429
84-2594	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016818	MN -37	9:46510
84-2598	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016823	MN -37	9:46523
84-2609	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016825	MN -32	9:47229

Report No.	Availability	Order No.	Distribution Category	Abstract No.
84-2611	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016826	MN -34B	9:46840
84-2620	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016827	MN -37	9:46356
84-2650	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016830	MN -59b	9:45753
84-2654	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016461	MN -37	9:46524
84-2658	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016463	MN -25	9:47044
84-2663	NTIS, PC A03/MF A01 (GPO Dep.)	DE84016464	MN -48	9:46630
84-2676	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016465	MN -37	9:46525
84-2683	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016466	MN -32	9:47230
84-2690	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016467	MN -20	9:47071
84-2696	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016783	MN -37	9:46526
84-2698	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016784	MN -41	9:45662
84-2711	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016799	MN -34D	9:46935
84-2712	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016800	MN -13	9:47222
84-2724	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016793	MN -59b	9:45754
84-2725	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016794	MN -59b	9:45755
84-2728	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016774	MN -25	9:46296
84-2735	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016771	MN -59b	9:45756
84-2736	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016772	MN -59b	9:45757
84-2741	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016773	MN -34	9:46430
84-2751	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016779	MN -38	9:47047
85-2639	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016829	MN -59b	9:45758
LALP-				
84-27	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017107	MN -34D	9:47052
84-42	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017106	MN -48	9:46631
LBL-				
15623	NTIS, PC A03/MF A01 (GPO Dep.)	DE84016896	MN -95d	9:45712
16086	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84016059	MN -95d	9:46123
17032	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016903	MN -25	9:46527
17378	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016894	MN -38	9:46528
17590	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016878	MN -95d	9:46124
17598	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016001	MN -11	9:46582
17603	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016888	MN -11	9:46569
17735	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016008	MN -25	9:46872
17889	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016885	MN -95d	9:46125
17927	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016889	MN -95f	9:46126
17968	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014571	MN -25	9:46873
17998	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016902	MN -95d	9:46127
18005	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015742	MN -48	9:46638
18051	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016908	MN -25	9:46198
18087	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016898	MN -95f	9:46128
18135	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016893	MN -25	9:46243
18136	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016891	MN -34A	9:46199
18139	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016899	MN -95d	9:46129
18151	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016002	MN -4	9:46297
18161	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016881	MN -34A	9:46850
18203	NTIS, PC A08/MF A01 (GPO Dep.)	DE84016950	MN -61	9:45725
18209	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016886	MN -25	9:46200
18236	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016904	MN -25	9:46201
LUIP-				
8305	*See* LUNFD6/NFFK-7028/1-21(1983)	DE84702888	MN -34C	9:46997
LUNFD6/NFFK-				
7028/ 1-21(1983)	NTIS (US Sales Only), PC A03/MF A01	DE84702888	MN -34C	9:46997
MEA-				
2048	*See* NUREG/CR-3833	TI84901828	MN -78	9:45973
MINTEK-M-				
114	NTIS (US Sales Only), PC A03/MF A01	DE84702896	MN -4	9:46269
121	NTIS (US Sales Only), PC A02/MF A01	DE84702898	MN -4	9:46270
MIT-				
3773-43	NTIS, PC A02; 3 (GPO Dep.)	DE84016872	MN -25	9:46232
MLM-				
3140(OP)	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016940	MN -34	9:46348
3173	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017071	STD -4	9:46543
3175	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016862	STD -25	9:45506
3179	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016985	STD -70	9:45581
3181(OP)	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016941	MN -45	9:46544
3183(OP)	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016942	MN -45	9:46233
3184(OP)	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016946	MN -45	9:46545
3185(OP)	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016945	MN -45	9:46546
3186(OP)	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016944	MN -45	9:46547
MMM-				
3824-35	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017118	MN -33	9:45677
MRC-R-				
825	*See* AD-A-140585/1			9:46838
MTR-				
79W00249	NTIS, PC A05/MF A01 (GPO Dep.)	DE84012987	MN -90f	9:45924
7693	NTIS, PC A04/MF A01 (GPO Dep.)	DE84014770	MN -95a	9:46083
N-				
83-34306	NTIS, PC A03/MF A01			9:46357
83-34307	NTIS, PC A03/MF A01			9:46358
84-12634	NTIS, PC A09/MF A01			9:45726
84-12636	NTIS, PC A02/MF A01			9:46034
84-12637	NTIS, PC A02/MF A01			9:45727
84-12663	NTIS, PC A02/MF A01			9:46797
84-12834	NTIS, PC A06/MF A01			9:46851
84-12890	NTIS, PC A02/MF A01			9:46359

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84-12909	NTIS, PC A03/MF A01			9:47125
84-12910	NTIS, PC A04/MF A01			9:47126
84-12911	NTIS, PC A03/MF A01			9:47072
84-12912	NTIS, PC A03/MF A01			9:46852
84-12913	NTIS, PC A03/MF A01			9:47073
84-12916	NTIS, PC A03/MF A01			9:47074
84-13044	NTIS, PC A03/MF A01			9:46798
84-13045	NTIS, PC A02/MF A01			9:46799
84-13046	NTIS, PC A03/MF A01			9:46800
84-13049	NTIS, PC A03/MF A01			9:46841
84-13064	NTIS, PC A08/MF A01			9:46801
84-13065	NTIS, PC A03/MF A01			9:46802
84-13067	NTIS, PC A99/MF A01			9:46803
84-13068	NTIS, PC A99/MF A01			9:46804
84-13069	NTIS, PC A99/MF A01			9:46805
84-13070	NTIS, PC A99/MF A01			9:46806
84-13071	NTIS, PC A99/MF A01			9:46807
84-13072	NTIS, PC A99/MF A01			9:46808
84-13073	NTIS, PC A99/MF A01			9:46809
84-13074	NTIS, PC A99/MF A01			9:46810
84-13075	NTIS, PC A99/MF A01			9:46811
84-13076	NTIS, PC A99/MF A01			9:46812
84-13077	NTIS, PC A99/MF A01			9:46813
84-13078	NTIS, PC A99/MF A01			9:46814
84-13079	NTIS, PC A99/MF A01			9:46815
84-13080	NTIS, PC A99/MF A01			9:46816
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84-13085	NTIS, PC A99/MF A01			9:46821
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84-13094	NTIS, PC A99/MF A01			9:46830
84-13095	NTIS, PC A99/MF A01			9:46831
84-13375	NTIS, PC A99/MF A01			9:46738
84-13376	NTIS, PC A99/MF A01			9:46739
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84-03	NTIS (US Sales Only), PC A02/MF A01	DE84702823	MN -34D	9:46911
NCRP-				
72	NCRP Publications, 7910 Woodmont Ave., Suite 1016, Bethesda, MD 20814	TI84901556	MN -41	9:46709
NEANDC(J)-				
98/ AU	*See* JAERI-M-84-052	TI84901546	ND -34C	9:46931
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34(549)	NTIS (US Sales Only), PC A02/MF A01	DE84702902	MN -4	9:46271
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12	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017403	STD -92a	9:45429
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1100-Rev.5	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017053	MN -70	9:45582
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2-67-2135	NTIS, PC A09/MF A01; 1 - NMERDI-Univ. of New Mexico, 117 Richmond Dr., Albuquerque, NM 87106	DE84901855	MN -66a	9:45859
2-68-2214	NTIS, PC A08/MF A01; 1 - NMERDI, Univ. of New Mexico, Suite M, 457 Washington S.E.; Albuquerque, NM 87108	DE84901651	MN -60	9:45914
2-69-2202	NTIS, PC A09/MF A01; 1 - NMERDI-Univ. of New Mexico, 117 Richmond Dr., Albuquerque, NM 87106	DE84901823	MN -66a	9:45860
2-69-2209	NTIS, PC A02/MF A01; 1 - NMERDI-Univ. of New Mexico, Suite M, 457 Washington SE, Albuquerque, NM 87108	DE84901772	MN -66e	9:45880
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4770363	NTIS (US Sales Only), PC A06/MF A01; 1	DE84770363	MN -13	9:46057
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4770376	NTIS (US Sales Only), PC A03/MF A01; 1	DE84770376	MN -13	9:46045
4770377	NTIS (US Sales Only), PC A10/MF A01; 1	DE84770377	MN -11	9:46570
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4770383	NTIS (US Sales Only), PC A03/MF A01; 1	DE84770383	MN -13	9:46046
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4770399	NTIS (US Sales Only), PC A03/MF A01	DE84770399	MN -92	9:46090
4770400	NTIS (US Sales Only), PC A11/MF A01; 1	DE84770400	MN -59	9:45759
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4770407	NTIS (US Sales Only), PC A03/MF A01; 1	DE84770407	MN -13	9:46054
4770408	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770408	MN -13	9:46055
4770409	NTIS (US Sales Only), PC A06/MF A01; 1	DE84770409	MN -94c	9:46043
4770410	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770410	MN -11	9:46585
4770411	NTIS (US Sales Only), PC A09/MF A01; 1	DE84770411	MN -94c	9:46313
4770412	NTIS (US Sales Only), PC A06/MF A01; 1	DE84770412	MN -04	9:46286
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4901298	NTIS, PC A04/MF A01; 1	DE84901298	MN -95c	9:46100
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4901354	NTIS (US Sales Only), PC A04/MF A01; 1	DE84901354	MN -59	9:45761
4901749	GPO*	TI84901749	MN -98	9:46058
4901765	NTIS (US Sales Only), PC A02/MF A01	DE84901765	MN -92	9:45416
4901770	Canadian Government Publishing Centre, Supply and Services Canada, Hill, Quebec K1A 0S9	TI84901770	ND -92	9:45417
4901775	Dept. of Development, Div. of Energy, 65 E. State St., Columbus, OH 43215	TI84901775	MN -95f	9:46152
4901785	Dept. of Development-Division of Energy, Box 1001, Columbus, OH 43216	TI84901785	MN -90a	9:45325
4901787	Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43214-1001	TI84901787	MN -90d	9:45326
4901789	Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216-1001	TI84901789	MN -90a	9:45388
4901792	Department of Development, PO Box 1001, Columbus, OH 43216	TI84901792	MN -61	9:46108
4901803	Dept. of Development, Div. of Energy, P.O. Box 1001, Columbus, OH 43216	TI84901803	MN -90c	9:45327
4901862	NTIS, PC A04/MF A01; 1	DE84901862	MN -11	9:46153
4901881	NTIS, PC A06/MF A01; 1	DE84901881	MN -90c	9:45384
4901887	NTIS, PC A07/MF A01; 1	DE84901887	STD -11	9:46611
4901952	NTIS, PC A03/MF A01	TI84901952	MN -11	9:46741
4901953	NTIS, PC A03/MF A01	TI84901953	MN -11	9:46665
4901955	NTIS, PC A03/MF A01; 1	TI84901955	MN -11	9:46612
NUREG-				
0020-Vol.8-No.7	NTIS, PC A17/MF A01 - GPO	TI84901831	MN -80	9:45929
0540-Vol.6-No.6	NTIS, PC A99/MF A01; 1 - GPO*	TI84901827	MN -2	9:45961
0606-Vol.6-No.3	NTIS, PC A06/MF A01; 1 - GPO*	TI84901853	MN -80	9:45998
0675-Suppl.27	NTIS, PC A04/MF A01 - GPO* $3.50	TI84901733	MN -78	9:45999
0750-Vol.19-No.4	NTIS, PC A10/MF A01 - GPO*	TI84901879	MN -2	9:45962
0831-Suppl.5	NTIS, PC A05/MF A01 - GPO* $5.00	TI84901949	MN -78	9:46000
0831-Suppl.6	NTIS, PC A10/MF A01 - GPO* $6.50	TI84901829	MN -78	9:46001
1084	NTIS, PC A05/MF A01; 1 - GPO* $4.75	TI84901852	MN -80	9:46002
1092	NTIS, PC A04/MF A01; 1 - GPO* $4.50	TI84901854	MN -70	9:45651
NUREG/BR-				
0025-Vol.10-No.6	NTIS, PC A02/MF A01 - GPO*	TI84901815	MN -70B	9:45583
NUREG/CR-				
1873	NTIS, PC A04/MF A01 - GPO	TI84017617	MN -80	9:46003
1982	NTIS, PC A02/MF A01 - GPO	TI84017626	MN -78	9:45932
3474	NTIS, PC A08/MF A01 - GPO $6.00	TI84017215	MN -78	9:46004
3569	NTIS, PC A09/MF A01; 1 - GPO	TI84016300	MN -78	9:46005
3589-2	NTIS, PC A08/MF A01 - GPO	TI84017046	MN -80	9:46006
3689-Vol.4	NTIS, PC A08/MF A01 - GPO	TI84017313	MN -78	9:46007
3692	NTIS, PC A04/MF A01 - GPO	TI84015503	MN -78	9:45933
3782	NTIS, PC A99/MF A01 - GPO* $15.00	TI84901956	MN -70	9:45658
3787	NTIS, PC A06/MF A01; 1 - GPO $5.00	TI84017092	MN -80	9:46008
3798	NTIS, PC A05/MF A01; 1 - GPO $4.75	TI84016960	MN -70B	9:45593
3821	NTIS, PC A02/MF A01 - GPO	TI84017105	MN -80	9:46009
3822	NTIS, PC A05/MF A01 - GPO	TI84017113	MN -78	9:45934
3830-Vol.1	NTIS, PC A05/MF A01 - GPO	TI84015504	MN -79	9:46010
3832	NTIS, PC A03/MF A01; 1 - GPO	TI84015114	MN -70	9:45594
3833	NTIS, PC A03/MF A01 - GPO* $3.75	TI84901828	MN -78	9:45973
3845	NTIS, PC A02/MF A01 - GPO	TI84017104	MN -79k	9:46011
3852	NTIS, PC A06/MF A01 - GPO $5.00	TI84017399	MN -78	9:46012
3856	NTIS, PC A03/MF A01 - GPO	TI84015545	MN -78	9:45974
3870	NTIS, PC A03/MF A01; 1 - GPO* $3.75	TI84901767	MN -41	9:46710
3921	NTIS, PC A02/MF A01; 1 - GPO	TI84017465	MN -85	9:45514
3932	NTIS, PC A06/MF A01 - GPO	TI84016161	MN -78	9:46013
NYSERDA-				
84-13	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84017216	MN -95d	9:46131
84-15	Dept. of Communications, New York State Energy Research & Development Authority, Two Rockefeller Plaza, Albany, NY 12223	TI84901958	MN -61D	9:45706
ORAU/IEA-				
84-10(M)	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017478	MN -92b	9:45444
ORNL-				
6018	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84016512	MN -41	9:46549
6036	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84016649	MN -90h	9:45328
6049	*See* NUREG/CR-3832	TI84015114	MN -70	9:45594
6081	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017637	MN -41	9:46014
6085	NTIS, PC A05/MF A01 (GPO Dep.)	DE84017634	MN -11	9:45729
ORNL/CON-				
164	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017470	MN -95d	9:46132
ORNL/CSD/TM-				
213	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017646	STD -86	9:45507
220	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017647	MN -32	9:46353
ORNL/FEDC-				
84/ 2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017645	STD -20c	9:47128
ORNL/NFW-				
83/ 40	NTIS, PC A03/MF A01 (GPO Dep.)	DE84016868	MN -71	9:45515
ORNL/NUREG/TM-				
441	*See* NUREG/CR-1982	TI84017626	MN -78	9:45932
ORNL/Sub-				
80-61619/ 1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84016647	MN -95d	9:46133
83-9062/ 1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84016676	STD -97b	9:46431

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ORNL/TM-				
8904	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84016583	MN -11	9:46589
8977	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84016555	STD -77	9:45943
9030	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84016554	STD -77	9:45944
9035	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016581	STD -13	9:46599
9052	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84017290	MN -90h	9:46234
9061	*See* NUREG/CR-3692	TI84015503	MN -78	9:45933
9083	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84016578	MN -34C	9:46977
9146	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84016742	MN -70B	9:45595
9172	NTIS, PC A03/MF A01 (GPO Dep.)	DE84016638	STD -20c	9:46202
9179	NTIS PC E08/MF A01; 1 (GPO Dep.)	DE84017648	MN -34C	9:47036
9182	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84016635	STD -20	9:47075
9193	NTIS, PC A02/MF A01 (GPO Dep.)	DE84017633	STD -20	9:47076
9206	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017649	STD -20g	9:47077
9217/ V1	*See* NUREG/CR-3830-Vol.1	TI84015504	MN -79	9:46010
9220	NTIS, PC A03/MF A01 (GPO Dep.)	DE84016574	MN -80	9:45985
9230	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016546	MN -20	9:47078
9236	*See* NUREG/CR-3856	TI84015545	MN -78	9:45974
9251	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84016636	STD -20d	9:47129
9252	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84017632	STD -77	9:45945
9318	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016576	MN -80	9:45986
ORNL-tr-				
5121	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012759	MN -4	9:46240
OTA-HCS-				
24	GPO*	TI84901861	MN -41	9:46662
OTA-ISC-				
240	Congressional and Public Affairs, Office of Technology Assessment, US Congress, Washington, DC 20510	TI84901739	MN -13	9:47223
P-				
400-84-001	California Energy Commission, 1516 9th St., Sacramento, CA 95814	TI84901562	MN -95	9:46085
500-84-004	CEC, 1516 9th Street, Sacramento, CA 95814	TI84901645	MN -58d	9:45715
PB-				
84-177831	NTIS, PC A12/MF A01			9:46595
84-178672	NTIS, PC A08/MF A01			9:45375
84-178680	NTIS, PC A16/MF A01			9:45376
84-178698	NTIS, PC A03/MF A01			9:45377
84-183110	NTIS, PC A03/MF A01			9:46168
84-184183	NTIS, PC A05/MF A01			9:46432
84-184373	NTIS PC E04/MF E01			9:45398
84-187269	NTIS, PC A03/MF A01			9:46622
84-189513	NTIS, PC A03/MF A01			9:46158
84-189935	NTIS, PC A03/MF A01			9:46586
84-189968	NTIS, PC A05/MF A01			9:46587
84-190586	NTIS, PC A02/MF A01			9:45881
84-191626	NTIS, PC A15/MF A01			9:46621
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84-193044	NTIS, PC A05/MF A01			9:46614
84-194562	NTIS, PC A08/MF A01			9:46588
84-199371	NTIS, PC A09/MF A01			9:46446
84-199579	NTIS, PC A07/MF A01			9:46615
181177	NTIS, PC A11/MF A01	TI84901890	MN -98A	9:45401
181178	NTIS, PC A08/MF A01	TI84901891	MN -98A	9:45402
PNL-				
4001-7	NTIS, PC A02/MF A01	DE84017293	MN -90g	9:46110
4432-9	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017025	MN -70B	9:45659
4824	*See* NUREG/CR-3474	TI84017215	MN -78	9:46004
4864	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84017389	MN -60	9:45915
4900	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017176	MN -60	9:45916
4915	*See* NUREG/CR-3569	TI84016300	MN -78	9:46005
5096	NTIS, PC A05/MF A01 (GPO Dep.)	DE84017177	MN -61F	9:45691
5101	*See* NUREG/CR-3787	TI84017092	MN -80	9:46008
5126	NTIS, PC A04/MF A01 (GPO Dep.)	DE84016357	MN -23	9:45667
5153	*See* NUREG/CR-3798	TI84016960	MN -70B	9:45593
5195	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017294	MN -95	9:46154
5225	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017400	MN -98F	9:47231
PPPL-				
2076	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017129	STD -20g	9:47079
2123	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017070	STD -20a	9:47130
2126	NTIS, PC A02/MF A0; 1 (GPO Dep.)	DE84017128	STD -20b	9:47131
2128	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017064	STD -20f	9:47080
2130	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017067	STD -20g	9:47081
2131	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017062	STD -20g	9:47082
2132	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84017068	STD -20d	9:47083
2134	NTIS, PC A03/MF A01 (GPO Dep.)	DE84017072	STD -20f	9:47084
2139	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84017069	STD -20f	9:47085
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TD Chad
TG Togo
TH Thailand
TN Tunisia
TO Tonga
TR Turkey
TT Trinidad and Tobago
TW Taiwan
TZ United Republic of Tanzania

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UG Uganda
US United States of America (USA)
UY Uruguay

VA Holy See
VD Democratic Republic of Vietnam
VE Venezuela
VS Republic of Vietnam

WS Western Samoa

YD Democratic Yemen
YE Yemen
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The system permits users to carry on a dialogue with the computer. This dialogue allows browsing through large data bases and can result in retrieval of citations which answer specific needs. Desired information can be selectively retrieved via simple yet powerful commands sent to the computer from the terminal keyboard.

Search logic may be formulated by the use of indexed terms, such as keywords, authors, categories, or corporate authors. As the search session progresses, AND, OR and NOT Boolean logic may be used to improve precision, i.e., the specificity of the retrieved set. For most data bases, the user may limit the scope of the search to particular years or volumes of data. Upon completion of a search, the user may choose to have the results displayed or printed at his/her terminal or to have the results printed and mailed the following day.

The DOE/RECON system is supported by dual IBM 370/3033 computers. Two IBM 3705 front-end communications computers are used to perform the message switching. Although most of the 40 data bases are bibliographic in content, DOE/RECON is not limited to this type; the Research in Progress (RIP) data base is one that is non-bibliographic. Presently, over 2 million references are available.

Requests for information concerning authorization to access the DOE/RECON system should be addressed to

RECON
Office of Scientific and Technical Information
Technical Information Center
U. S. Department of Energy
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